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ORIGINAL MEMOIRS.

THE RESULTS OF "SPECIFIC" REMEDIES IN DISEASED STATES ACCOMPANIED BY HYPERTROPHY OF THE THYROID.*

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EXPERIMENTAL EVIDENCE AS TO THE PHYSIOLOGY OF THE THYROID, AND A THEORY FOR ITS FUNCTION.

THE adrenal glands contain in their medullary portion the largest collection in the body of what are designated as chromaffin cells. These are the source of adrenalin, or the only known active constituent of these organs. The rest of the chromaffin cells occur in scattered areas and in greater or less amounts throughout the distribution of the sympathetic nervous system and its ganglia. These secreting cells develop from the same original sources as the sympathetic nerves and, in fact, appear to be a part of them. The individual cells present the morphology and microchemical reactions of secreting epithelium, and yet the aggregations of chromaffin cells show some differences from the usual structure of secreting glands. The largest collections of this peculiar tissue

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outside of the medullary portions of the adrenals exist in the carotid "gland," in some of the larger sympathetic ganglia, chiefly in the abdomen and in the Luschka's coccygeal "gland." It is not sufficient, therefore, to refer to the adrenals alone when considering their internal secretion, as there are many more cells than are found in them for the production of their secretion. Hence the term "chromaffin system" must be employed to accurately describe the medullary secreting or chromaffin cells of the adrenal glands, together with the cells having an apparently similar function and situated in more or less abundance in many other parts of the body,—and this term includes with the chromaffin cells all of the sympathetic nervous system. These chromaffin cells have the peculiarity, therefore, of being an integral part of the sympathetic nervous system and by their secretion of stimulating the terminal filaments of these nerves alone. In other words, it appears to be an example of an organ which in one sense may activate itself in that the product of the chromaffin cells, or adrenalin, activates the terminal sympathetic nerve filaments; and the chromaffin cells and the sympathetic nerve cells are in point of development one.¹ If this principle is correct for one organ or system it may be for another, and therefore the possibility of autoactivation is important in constructing a theory for the physiology of the thyroid, as will be noted later. The cortical portions of the adrenals exist in all animals, but do not belong to the chromaffin system, and nothing definite is known of the function of this tissue except that it does not seem to be of vital importance. The chromaffin system is innervated only by the sympathetic while the thyroid and the pancreas have an additional nerve supply from the vagus, or one of the "autonomous" nerves, according to Pawlow, Langley, and Elliot. In the pancreas, stimulation of the sympathetic nerve supply is said to produce an increased flow into the intestine of a watery fluid which contains little or none of the digestive

¹ Kohn, in Merkel and Bonnett *Ergebnisse*, Bd .xii, 1902, p. 253.

ferments, and so corresponds to similar experiments with the parotid secretion.

The well known experiments of Starling with an extract from the duodenum ("secretin") which he has proved capable of stimulating the functional activity of the pancreas by a "hormone" or chemical substance affecting the gland through the circulation, adds to the complexity of the problem, and suggests, if it does not prove, the close relationship of one organ with another. The apparent importance of the functional activity of the pancreas in the mechanism of thyroidism must be frequently referred to, and this activity as reviewed above is regulated by both chemical and nervous influences.

Comparatively little is known of the secretory activity of the thyroid except that it has an autonomous and sympathetic nerve supply, as stated before, and hence it is presumable that its output varies in amount at least, if not in quality; and this seems regulated automatically according to need.

An elaborate series of experiments by Eppinger, Falta, and Rudinger² supplies the best evidence yet obtained of the relationship which seems very close in cases of Graves' disease, between the thyroid, pancreas, and chromaffin system. A summary of their conclusions goes to prove that the thyroid and chromaffin system interact upon each other; that both the thyroid and the chromaffin system exert an inhibitory effect upon the pancreas, which these authors describe as "intense"; that the pancreas, on the other hand, exerts an "intense" inhibitory influence upon the activity of the thyroid and the same effect upon the chromaffin system. To make clear the results of their experiments showing this remarkable relationship they present a diagram in the shape of a triangle (Fig. 1).

However, much the conclusions set forth in this article may be doubted, it seems to be pretty well established that the chromaffin system through its adrenalin product is capable of inhibiting the functional activity of the pancreas, as evi-

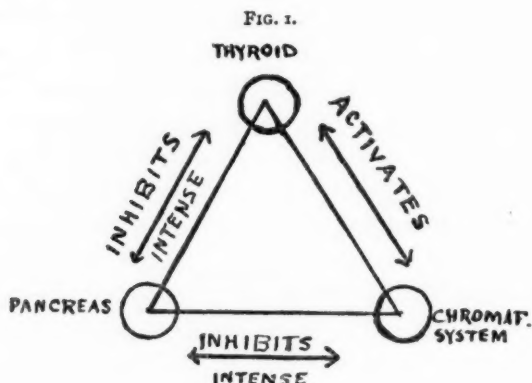
² Zeitschr. f. klin. Med., 1908, v 63, p. 1.

denced by the adrenalin-pancreas diabetes in Herter's well-known experiment. This is important in the construction of an hypothesis for the pathological physiology of the over-active thyroid.

It is suggested in the above experiments that the culmination of the interaction of these three organs may take place in the liver,—and there is much to support this view, but as yet it has not been proved.

AN HYPOTHESIS FOR GRAVES' DISEASE.

A theory for the normal physiology of the thyroid and for its pathological condition in Graves' disease must not violate the facts which seem to be established in the above experiments



and must conform to and reasonably explain all the clinical observations narrated in the case histories. The fact that there seem to be two active principles which can be isolated from the thyroid, two from the adrenal and one from the pancreas, in addition to the fully formed pancreatic enzymes, necessarily complicates any hypothesis; but all of these must be taken into consideration. The most important in the construction of this theory are the thyroid nucleoprotein and the thyroid globulin. As stated previously, the thyroid nucleoprotein seems to be limited in its effect to increasing the rapidity of the heart action, and it is assumed to do this through

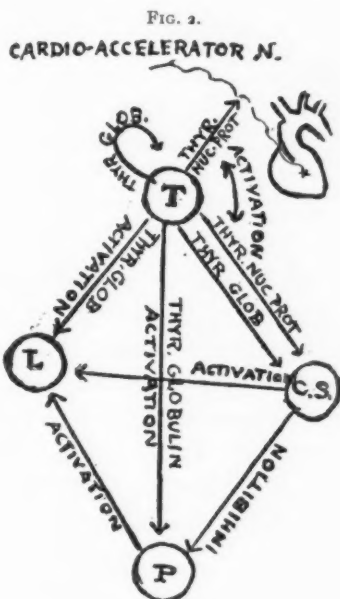
a direct stimulant effect upon the cardio-accelerator or a sympathetic nerve. The chromaffin system is intimately connected with this if it is not a part of it, and no great stretch of imagination is required to believe that the nucleoproteid element in the thyroid secretion, which apparently increases in direct proportion to the severity of the symptoms of thyroidism, also has a direct stimulant effect upon the whole sympathetic or chromaffin system. Thus the thyroid may through the nucleoproteid portion of its product acting upon the chromaffin system inhibit the functional activity of the pancreas. Clinically, the thyroid nucleoproteid seems to remain constant in its physiological effects throughout all the stages of Graves' disease. As the gland becomes degenerated or sclerotic it is conceivable, however, that its total quantity may decrease in amount. The thyroid globulin or second active constituent of the gland, on the other hand, appears to have an effect which is not limited to any one organ or system like the nucleoproteid; it does not increase the rapidity of the heart action except in excessive dosage, and then the tachycardia or nervousness can reasonably be ascribed to the seemingly inseparable small amount of nucleoproteid material with which the thyroglobulin is contaminated in its preparation. Furthermore, in contrasting these two substances there is some evidence for believing that the thyroid globulin, though it may be excessive in amount, slowly or rapidly deteriorates in its physiological qualities as exophthalmic goitre advances through its different stages. This is suggested not only by the variation in symptoms and the clinical advantage of administering a concentrated normal thyroid globulin in certain cases, but by the characteristic changes which take place in the thyroid gland of Graves' disease and of the goitres which give the signs of thyroidism. The histological structure and the content of iodine per gram of gland have already been referred to.

In the absence of proof and for the purpose of the hypothesis it must be assumed that the thyroid globulin has a universally activating effect which is concerned with some funda-

mental or common chemical process in all the organs and tissues of the body. This violates no known facts, and is suggested by clinical observations in a great variety of pathological conditions. If it activates all organs and tissues the thyroid gland itself should not be an exception, and therefore it is supposed that the thyroid epithelium is to a certain extent activated by part of its own product which returns in the circulation to its source. Hence there are to be considered the thyroid nucleoproteid, which is constant in quality and limited in its effect to the sympathetic nerves or chromaffin system—including, of course, the medullary portion of the adrenals; the thyroid globulin which with the progress of thyroidism deteriorates in quality but yet may increase in abundance as a form of compensation for its deficient quality; and a possible autoactivation of the gland by its own thyroglobulin.

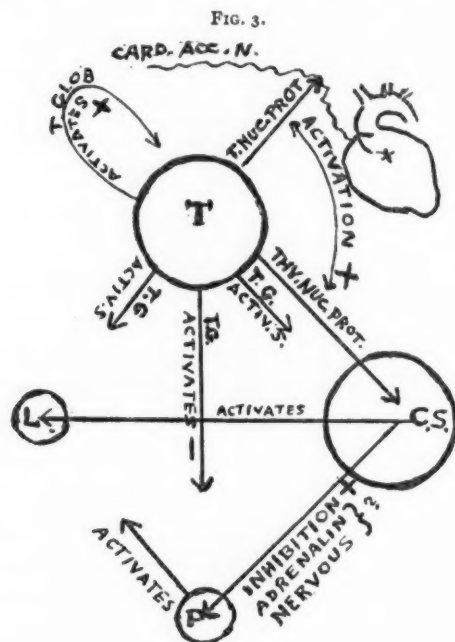
To explain the phenomena of Graves' disease the connection between the thyroid, pancreas, and chromaffin system and their possible effect upon the liver must be brought in. In any condition of over-strain or fatigue it is probable that the output of every secreting organ becomes impaired in quality, and to this general rule the thyroid can form no exception. But its product is assumed to be universally activating,—in other words, necessary for the important chemistry of nutrition in every organ and tissue in the body. Therefore, as a result of fatigue and impoverished nutrition there is a great demand for the thyroid secretion, and it is automatically supplied by the gland through proliferation and increased activity of its epithelium, and the colloid is thus increased in quantity but the quality is poor. There is poured into the circulation as a result of the output a large amount of thyroglobulin, and this carries with it too much nucleoproteid material which over-stimulates the whole sympathetic nervous system including the heart and the adrenals. The chromaffin system through the sympathetic nerves is thus forced to inhibit the functional activity of the pancreas, and the important digestive and nutritional processes which should be carried on in

the intestines become impaired or disordered and the general nutrition, already damaged by fatigue, suffers still further. There follows an increased demand for the poor quality of thyroid secretion which is supplied again in too great abundance with stimulation of the sympathetic nerves and inhibition of the pancreas, and thus what may be called the first vicious circle becomes established. The second vicious circle is assumed to lie in the superabundance of poor thyroid globu-



lin, which may be insufficient for some organs and to produce in them an irregular or pathological functioning, yet it returns in the circulation and, in conjunction with the automatic stimuli of a nervous or hormone character, compels the gland to continue its pernicious activity. In the first vicious circle, which is supposed to concern the functional activity of the thyroid, pancreas, and chromaffin system, it seems probable that the alteration in the so-called internal secretion of the pancreas and the hypothetical though highly important effect of this upon the liver, and also the hypothetical direct

effect of the abnormal thyroglobulin upon the liver, pancreas, and chromaffin system, are factors of great consequence. The chief disturbance, however, is assumed to be impairment of nutrition dependent upon inhibition of the functional activity of the pancreas by the over-activity of the chromaffin system, which in turn is supposed to be excited by the superabundance of the thyroid nucleoproteid in the abnormal thyroid secretion. The last abnormality, which is also the first in origin, arises



as a result of fatigue. This theory does not deny the important possibility that the chromaffin system and not the thyroid may occasionally begin the disturbance. If the chromaffin system is activated by its own secretory product, or adrenalin, as it appears to be, as well as by the thyroid nucleoproteid, then under extreme nervous strain particularly it is conceivable that an over-acting chromaffin system may inhibit the pancreas and this, by damaging nutrition, impair the quality of the thyroid secretion; in other words, bring about an excess of

the thyroid nucleoproteid element which then accentuates the difficulty in the already over-acting chromaffin system which in turn is thus stimulated by the thyroid nucleoproteid as well as by its own adrenalin. This reversal, so to speak, of the usual vicious circle, has to be considered in the cases of death from an apparent acute exacerbation of thyroidism following partial thyroidectomy and also in the few cases in the early stages of thyroidism which are manifestly made worse by the antithyroid serum; clinically these cases can be benefited only by the thyroid globulin given subcutaneously or by pancreas feeding.

A diagram to illustrate this theory would then be somewhat as shown in Fig. 2. Under normal conditions the thyroid should be at the superior angle of a diamond-shaped figure at each point of which the other organs are represented of equal size to indicate their equilibrium.

The supposed activating effect of the thyroglobulin is represented by arrows. Arrows represent the hypothetical internal secretions of the pancreas and chromaffin system and their supposed effect upon the liver and each other.

In Fig. 3 is represented the disproportion of these organs produced by an excessive quantity but poor quality of thyroid secretion. The thyroid nucleoproteid is represented by arrows marked *T, N, P*. The thyroglobulin by arrows marked *T, G*. The thyroglobulin appears to have no effect upon the cardio-accelerator nerve proper, and so is not shown leading to this nerve, but the thyroglobulin may have some effect upon the chromaffin system in general, and is shown leading to the system. Its apparent deterioration in quality is represented by shortened arrows. The arrow leading from the chromaffin system to the pancreas is marked as carrying nervous or adrenalin impulses because of the known inhibitory effect of adrenalin upon the pancreas and because stimulation of the sympathetic nerve supply impairs the intestinal digestive quality of the pancreatic secretion (Pawlow).

In extenuation of the temerity manifested in the presentation of this somewhat complicated hypothesis it should be

stated that all the evidence as yet obtainable for the pathogenesis of Graves' disease goes to prove it an extremely complicated disorder and in my experience one which has a very high ultimate mortality. That some cases can be cured by appropriate interference has been definitely and repeatedly proved. It has likewise been demonstrated that improper or injudicious treatment either by thyroidectomy or by the administration of iodine or antithyroid serum or thyroid substance may result fatally. Hence in these perplexities one who assumes the responsibility of caring for patients suffering from thyroid disease must formulate some consistent plan on which to found therapeutic efforts, and the hypothesis stated above has served me as a safe and fairly reliable guide in many puzzling situations.

THERAPEUTICS.

A little elaboration of this theory for therapeutic purposes may explain its usefulness. The over-fatigued individual who develops a goitre without other symptoms should not have the goitre excised. It apparently represents a thyroid gland which has hypertrophied to supply a large amount of thyroglobulin to compensate for the demands of the body; and the proper treatment, theoretically at least, should be to feed such an individual the active principles of the thyroid, in their normal proportion; in other words, the combined thyroid proteids. At the same time there is a necessity to correct the bad hygienic conditions which appear to have caused this compensatory hypertrophy. For if the fatigue or nervous and physical strain is continued experience proves the possibility which amounts to probability, that thyroidism will follow. All goitres, as mentioned previously, seem to contain this ever present menace. Over-strain apparently damages the vitality of the thyroid and its ability to properly take up and utilize the necessary iodine; as a result there is an excessive proliferation of epithelium, the nucleoproteid element exceeds its normal proportion and there is poured out an excessive quantity of poor quality of secretion and the establishment of one or both

vicious circles. Both have to be considered, one lying in the triangle formed by the thyroid, pancreas, and chromaffin system, and the other in the autoactivation of the thyroid, because some of these simple goitres which exist without causing any constitutional symptoms seem to be changed into the exophthalmic variety by thyroid feeding in injudicious or excessive amounts. The most reasonable explanation of this involves a belief that the vitality of the thyroid has previously been strained to the normal limit, and when this is exceeded by thyroid feeding a species of autoactivation is added to the automatic stimuli and the epithelium proliferates too rapidly and an excess of the nucleoproteid element takes place in the secretion.

A few innocuous simple goitres seem to be changed into the more serious exophthalmic variety by injudicious medication with iodine, and something of the same disturbance as that just mentioned may occur. The goitre must be supposed to have reached the limit of its normal compensation and then an excess of iodine in the circulation supplies more of this element than the existing epithelium can properly assimilate and a more or less rapid proliferation takes place. As a result there occurs an excess of nucleoproteid in the secretion and consequent abnormal activation of the sympathetic or chromaffin system, and the thyroid-pancreas-chromaffin system vicious circle arises.

The possibility of a compensatory hypertrophy which may be the reverse of this has already been mentioned. That is, in the presence of an insufficiency of iodine in the circulation dependent upon an insufficiency of ingested iodine, it is conceivable that the gland may enlarge in an effort to obtain iodine for the manufacture, so to speak, of the necessary amount and quality of thyroid secretion. That calcium may be involved is merely speculation. The points of importance are that simple goitre may occur without apparent precedent or accompanying fatigue: That it must be primarily of a compensatory nature; and therefore should not be operated without good reason. The most common cause of simple

goitre, however, seems to be connected directly with fatigue and impairment of the general nutrition in which that of the thyroid participates. With the relief of these attendant causative conditions the subsidence of the compensatory hypertrophy may be complete; or it may be incomplete, and scattered areas or one lobe may remain enlarged. Under the latter circumstances, as remarked before, it must be supposed that the natural outlet for the thyroid secretion has become blocked during the period of excessive function, which was normal in that the vitality of the gland had not been damaged sufficiently to cause it to produce an excess of the nucleoprotein portion of its output. The closure, probably mechanical, of the natural outlets for the thyroid secretion practically leaves only half of the gland to functionate. Then under any prolonged strain the automatic stimuli, delivered to the whole gland, quickly force the damaged portion to attempt to supply the demand, and the consequent proliferation of its epithelium leads to an excess of the injurious nucleoprotein material. Hence the logical procedure is not to administer antithyroid serum, but to excise the degenerated area and to assist the presumably insufficient residue by thyroid feeding and good hygiene until the requisite compensatory hypertrophy can take place. As little normal gland tissue as possible should be sacrificed. The administration of the specific antiserum should only inhibit the action of a damaged organ which is trying to do its duty, and while it may thus check exacerbations of thyroidism, the antiserum would ultimately do harm rather than good. There is, however, always some danger of what is here called "auto-activation" if the thyroid feeding is pushed too far.

The therapeutics of Graves' disease according to this theory depends upon the stage which the process has reached and involves primarily the condition of the thyroid. Some glands seem congenitally weak; in other words, the biochemical relations of the epithelium to iodine become disturbed with the slightest impairment of the general nutrition. Any unusual amount of automatic stimulation seems to cause the

epithelium of these deficient organs to proliferate and produce both an excessive quantity of thyroid nucleoproteid and a poor quality of abundant thyroid globulin. In this class should be grouped the patients without any appreciable goitre yet with all the other signs of thyroidism and generally with a more or less distinct family history of disease connected with this organ. These cases are quite numerous and occur mostly in young girls about the age of puberty and represent the incipient stage of exophthalmic goitre. One or two injections of the antithyroid serum may be needed, but the indications are all for supporting rather than opposing the theoretically attempted compensation; the combined thyroid proteids administered alone or with some pancreatic preparation ought to yield the best results. To remove half of the gland in such a patient is an almost irreparable calamity. It is almost and not entirely irreparable because youth and the best of hygiene and careful nutritional therapeutics may surmount great obstacles and the proper compensation may eventually be regained.

As a general rule the more vigorous and robust the individual before the appearance of fully developed thyroidism and the earlier such an individual comes under observation the better is the prospect for operative success. This is apparently obtained by breaking both of the (theoretical) vicious circles, in that removal of the usual half of the gland and the subsequent enforced confinement to bed and good hygiene takes away the superabundant secretion and allows the chromaffin system, pancreas, liver, and thyroid to resume their normal relations. But if the convalescence is not carefully guarded relapse is almost a certainty. Later in the progress of the disease, however, when it is presumable that the thyroid secretion has become badly impaired in quality, radical operation should and does have a much worse prognosis. A half of a slightly damaged gland may with some hygienic and medicinal assistance functionate perfectly, but not when its vitality has become seriously injured. Under these conditions ligation of one to three of the largest afferent vessels and

strict enforcement of rest may in course of time cause great improvement by cutting off the excess of auto-activation and frequent exacerbations of thyroidism; and so with the improvement of general nutrition that of the thyroid participates, and the gland may again become able to properly take up and utilize iodine. After this period has been reached radical operation might offer some hopes of success, but not before.

In the myxœdematoid stage of thyroidism no form of operation should be beneficial.

Case 23 (detailed on page 168) shows the doubt which always exists as to the outcome of partial thyroidectomy even in the early stages of typical Graves' disease. This experience can be interpreted in two ways: Either the apparent acute and fatal exacerbation of thyroidism after operation was produced by an excess of the thyroid nucleoproteid which was squeezed into the blood during the operative manipulation of the gland and thus over-activated the chromaffin system; or the fatality was not from so-called thyroidism but from an independent and unrestrained over-action of the chromaffin system. The universally activating thyroid globulin though of poor quality must have kept some of the pancreas from becoming quiescent, and thus theoretically must have exerted some inhibition upon the chromaffin system; but after removal of the thyroid there remained no inhibition of the self activated chromaffin system, and the latter produced the increasing tachycardia, and in the failure of both thyroid and pancreas the toxæmia which might be traceable to the liver. This explanation is conceivable from the experiments of Eppinger, Falta, and Rudinger, and does no violence to the hypothesis advanced above for the mechanism of Graves' disease. The possibility of the preponderance of the influence of the chromaffin system in the disturbance must always be taken into consideration. As the clinical history and the symptoms seem to be the same as when the thyroid may be assumed to be the principal factor, the most logical as well as the only way at present of determining the proper and safe therapeutic course to pursue lies in the experimental administration of the

specific antithyroid serum. If the thyroid is the principal organ at fault and the true key to the situation, an injection of five or ten minims of the antiserum will either be entirely negative in its results or there will be within the next twenty-four or forty-eight hours some slight improvement in the subjective or objective symptoms. If there is no change in forty-eight hours a slightly larger dose can then safely be attempted. Rarely this may have to be repeated every other day for a couple of weeks before improvement can be detected. But if the chromaffin system can be assumed to be at the bottom of the disturbance and the thyroid only involved secondarily, so to speak, the antiserum will almost immediately or very soon aggravate all the symptoms and the apparent thyroidism will be intensified. By proceeding cautiously with the antithyroid serum this necessary experimentation is never dangerous and practically seems to be a most reliable guide as to what may be expected from radical operation. For in Dr. Beebe's statistics there have been nine deaths from an apparently acute exacerbation of thyroidism following partial thyroidectomy. These fatalities were all in cases which had failed to improve under a preliminary antiserum treatment. In the writer's personal and early experience there have been four cases which showed no improvement under the antiserum treatment and then sought surgical relief elsewhere with the result of only one death but of three failures to cure. In several later cases, however, after slight improvement under the antiserum, it has seemed justifiable to save time and expense by radical operation, and so far these patients have shown no ill effects and have proved perfect cures. The antithyroid serum can therefore be regarded as of considerable diagnostic and prognostic value, and when the chromaffin system may theoretically have a greater influence than the thyroid in a case of thyroidism the antithyroid serum should indicate the danger. If it alleviates any symptoms then radical surgery in competent hands is probably safe and may offer a speedier good result; but whether it is wiser for the future remains to be determined.

If the antiserum proves of therapeutic assistance it should be continued as long as improvement is perceptible, but the pancreas which is theoretically also at fault, should be constantly aided by the administration of this organ in some form in protected capsules by mouth or preferably by rectum or subcutaneously. Trypsin or the commercial preparation known as "holadin" and pancreatin or the nucleoproteid material of the pancreas should be tried, and generally one more than another will be found of some value though their effects are seldom striking or immediate. If the antiserum or the pancreas products are slowly beneficial more gain may sometimes be obtained by the cautious addition to the medication of gr. $\frac{1}{50}$ of the combined thyroid proteids, preferably from the sheep gland, as this contains more thyroglobulin than the pig gland. The thyroid feeding is supposed to "help out" the poor quality of the patient's thyroid secretion, but its administration must be stopped or postponed if any intensification of the existing thyroidism follows. If the antiserum after one or more trials proves injurious, and even in the early stages of the disease, as remarked above, this may occasionally happen, then the 1:1000 solution of the thyroid globulin can be tried in a five-minim dose subcutaneously once or twice daily, and be stopped if any intensification of the thyroidism follows. The thyroglobulin thus given is harmless and is almost a specific for the colitis and diarrhoea which often occur in the later stages of chronic thyroidism. But the frequent loose movements of the earlier period will be made more troublesome by its administration and can only be controlled by the antiserum. The pancreas medication is, however, almost always useful at any time, and seldom or never seems harmful. The thyroid nucleoproteid solution for subcutaneous administration may rarely prove beneficial in some myxoedematoid conditions, but in my experience has a very limited field. In these later stages of thyroidism, with a presumably exhausted thyroid and a chromaffin system whose secretory activity also may approach exhaustion though its nervous activity appears great, the adrenal nucleoproteid

seems beneficial, especially if the blood pressure is high or if there is noticeable pigmentation of the skin.

The therapeutics of this peculiar disease are thus largely a matter of cautious experimentation in each case and seem to depend chiefly upon the vitality of the thyroid and its ability to properly take up and utilize iodine. To remedy this defect, the nutrition in general and that of the thyroid in particular, must be carefully fostered by good hygiene. The vicious circles which have theoretically become established must be broken by partial thyroidectomy or by ligation of not less than one nor more than three of the thyroid vessels at one sitting; or repeated injections of the antithyroid serum must be employed to check the abnormal activity of the thyroid epithelium and to neutralize its superabundant globulin product and thus break both vicious circles. But the antithyroid serum must not be pushed to the point of unduly damaging the vitality of the already weakened epithelium, or the automatic mechanism which controls the quantity of the thyroid product will compel the gland to overact worse than previously. Under these conditions which can only be ascertained by experimentation, the pancreas should be aided and also, especially in the late stages, the thyroid itself and possibly the chromaffin system.

The first two histories represent cases of "leaking retention cysts" of the thyroid.

CASE 370.—Miss N., age 22, has noted a small goitre for five or six years. It first appeared after a period of rapid growth and hard study, and some nervousness and insomnia was remembered to be coincident with the diffuse enlargement of the neck. Later all symptoms disappeared, including the symmetrical goitre, but a localized tumefaction near the middle line persisted. In February, 1909, there was a sharp attack of tonsillitis which was accompanied by fever, a pulse rate of 130 to 150, throbbing heart action, nervousness and insomnia. With these disturbances the "lump in the neck swelled up" and caused slightly stridulous respiration. These symptoms gradually disappeared, but in March, after an automobile accident, the thyroidism was quite marked for some days. In April there was another recurrence,

following or accompanying some digestive disturbance. This again subsided to recur at irregular intervals and for longer or shorter periods. The chief complaint was of throbbing and rapid heart action accompanied by some dyspnoea and insomnia, beginning without appreciable cause and generally during the night, and with this a marked feeling of weakness. During the attacks, which were becoming more frequent, the palpebral fissure seemed wider, but there was no true exophthalmos. There existed a sharply circumscribed globular tumor about $1\frac{1}{2}$ inches in diameter (apparently in the right extremity of the thyroid) which felt like a rather tense cyst.

In June, 1909, under nitrous oxide and oxygen anæsthesia, this was excised. The right lobe was turned out on the neck and split open from behind; a globular tumor, sharply defined by a capsule, was enucleated from the surrounding gland tissue, which appeared normal. The recovery was uneventful and the patient returned to her home after ten days.

Before the operation the administration of the 2 per cent. tablets of combined thyroid proteids was followed almost immediately by tachycardia, nervousness, insomnia and weakness; afterwards their administration seemed rather to slow than to increase the pulse rate and quite decidedly to improve the sleep, strength and weight, with a gain of 25 pounds in the next three months:

PATHOLOGIST'S REPORT.

The tissue examined is a well-circumscribed mass surrounded by a definite capsule within, which projects several finger-like masses of thyroid tissue. These are surrounded by a little thin yellowish fluid which escapes on opening the capsule of the tumor. The projecting masses resemble papillary adenomata in the gross, arising from the capsule, but microscopically they fail to show neoplastic characters. They are composed of many small alveoli with pale colloid or none, supported by stroma which is hyaline and infiltrated with thin colloid. There are a few small, very vascular areas such as are seen in active Graves's disease, but the cells lining most of the alveoli are small, transparent and with very small nuclei. There are many widely dilated spaces, probably dilated alveoli, which apparently communicated with the general cavity surrounded by the main capsule. These spaces are empty and no definite colloid was present in any portion of the mass.

CASE 335.—Mrs. D., 64 years of age, first noted a goitre twelve years previously while caring for her husband who was dying slowly of cancer. Anxiety checked her appetite and she

was unable to obtain a proper amount of sleep for months and suffered greatly from physical and nervous strain. After his death she was afflicted for a considerable period with nervousness, insomnia and palpitation of the heart after the slightest excitement or fatigue, and a "lump" in the neck appeared. Then all symptoms gradually subsided, including the goitre on the right side of the neck but that on the left shrank only to a slight extent. Following this there was a long interval of good health, though the goitre remained unchanged until July, 1907, when she began to grow somewhat stouter, and after excitement or exertion suffered again from palpitation, nervousness and insomnia, and dyspnœa which soon became accompanied by stridulous respiration. The freedom from symptoms obtained by sedatives and repose grew shorter and the exacerbations of thyroidism longer and more distressing, and relief—especially from the difficulty in breathing—seemed imperative. When quiet, the only abnormality to be detected was a soft left-sided goitre about the size of an orange, pressure upon which caused stridulous respiration, and this was increased to almost complete obstruction by raising the left arm above the head. The right lobe was not appreciably enlarged.

In February, 1909, under nitrous oxide and oxygen anaesthesia the enlarged left lobe was excised by an L-shaped excision. There was a soft vascular portion situated deep in the neck behind the clavicle and sternum, and the profuse hemorrhage which followed its delivery onto the surface looked like a laceration of one of the large thoracic veins. The ensuing necessary rapid sponging and clamping showed well the possibility of injury to the recurrent laryngeal nerve which might be unavoidable under these circumstances. An uneventful recovery, however, took place with complete relief of all symptoms. During convalescence it was evident that exertion or excitement produced a slight feeling of pressure or constriction in the region of the remaining lobe of the thyroid, though during the operation it was exposed and presented no noticeable abnormality. This sensation was relieved entirely, as was the accompanying slight constipation and feeling of indigestion, by administration of the 2 per cent. tablet of the combined thyroid proteids previously described. This pro-thyroid treatment has been continued with entirely satisfactory and apparently beneficial results.

PATHOLOGIST'S REPORT.

The tissue examined is composed of an excessive number of small regular alveoli deficient in colloid, among which are scattered a number of slightly distended alveoli. There are wide variations in the staining quantity of colloid between very light staining areas and very dense and opaque masses. In some areas there is much interstitial colloid in which lie small isolated alveoli. This appearance is similar to that of the myxœdema thyroid. There are several irregular cysts filled with colloid.

This thyroid resembles that of myxœdema more than that of typical Graves's disease.

The following histories narrate instances of the specific treatment of thyroid disease:

CASE 1.—Miss F., age 27, presented severe typical exophthalmic goitre in the early stages though of two years' duration. Pulse 130–160; large symmetrical elastic goitre. Largest circumference of neck 14 inches; respiration 26–28; moderate exophthalmos; marked tremor; moist skin. In April, 1905, she received three injections of the antithyroid serum during one week and no other treatment subsequently except a hygienic mode of life. There followed a marked improvement after the first injection and while she was by no means immediately cured by these injections, the change for the better was thus started. During the following summer all traces of the disease except the goitre disappeared, and after one year not even the goitre existed. This woman remained well and without any signs of disease until June, 1909, when for several weeks she was compelled during a period of hot weather to work early and late, often going without meals and sufficient sleep. She then noticed a recurrence of the tachycardia with "thumping" heart and insomnia, and immediately applied for relief. There was no goitre nor exophthalmos, and the above were the only signs of thyroidism. The only change made in her mode of life were 12 hours out of 24 to be passed in bed and regular periods for eating; for medication she was given 6 grains of a pancreatic preparation (Holadin) in protected capsules an hour before meals and at night. At the end of two weeks the pulse had dropped from an average of 110–115 to 75–80 and the insomnia and nervousness had disappeared. At present (four months later), there are no signs of any disease.

CASE 82.—Mrs. L., aged 39, presented typical severe exophthalmic goitre of two years' duration. Marked exophthalmos, large symmetrical firm goitre, largest circumference of neck

15½ inches; pulse 130-140; respirations 30-35; emaciation; moist somewhat pigmented skin; frequent soft stools; weakness, nervousness, insomnia and distressing thirst. From June to December, 1907, injections of antithyroid serum were given at first every other day, then twice and finally once weekly. There was gradual improvement, and on November 30, 1907, the exophthalmos and goitre were decidedly less and the patient noticeably improved. Neck 13½ inches in circumference; pulse 100-120. In December the injections of antithyroid serum seemed harmful rather than beneficial, the pulse began to rise, the weakness increased and the appetite failed; a diarrhoea with light-colored stools developed and the skin instead of being moist was noticeably dry. The antiserum was therefore stopped and a tablet containing one-fiftieth of a grain of the combined thyroid nucleoproteid and globulin from sheep's glands was given by mouth four times daily. An almost immediate improvement in all symptoms followed, and in January, 1908, her physician considered her cured, though I have placed her in the "improved" class as there are still traces of thyroid disorder which suggest a myxœdematoid condition. At this period of our experience the differences between the nucleo-proteid and globulin were suspected but not clearly recognized.

CASE 126.—Mrs. P., aged 28, presented typical rather severe exophthalmic goitre of about two years' duration, but the color of the skin was very white and it was dry except after exertion. Some œdema of the legs; the hæmoglobin was 60 per cent.; symmetrical firm goitre; circumference of neck 13½ inches; pulse 120-130. In December, 1907, two injections of antithyroid serum were given with intensification of all the symptoms and in addition a rise of temperature to 103° F. After an interval the exacerbation subsided and iodine in the form of one grain of iodide of iron pills, was tried. At first there was some improvement, but the goitre enlarged and hardened until the neck measured 14 inches in circumference and the patient complained of a sensation of constriction of the neck. A week later there was a violent attack of gastro-enteritis and another exacerbation of thyroidism. After its subsidence the combined sheep thyroid nucleoproteid and globulin was tried by mouth cautiously, and stopped, as this medication increased the tachycardia and diarrhoea. The normal human thyroid nucleoproteid was next given in very small dose subcutaneously; but it increased the nervousness and tachycardia,

and finally the solution of the normal human thyroid globulin was administered. The night following this injection the patient slept nine hours for the first time in weeks and the following morning the pulse had dropped from 130 of the previous evening, to 96. This remarkable improvement, however, did not last through the day and the next night was poor, though a little better than usual. The injection was therefore repeated though with not quite as good a result as the first time. Improvement, however, gradually followed daily injections of this normal human thyroid globulin. In May, 1908, it was stopped, as the patient seemed entirely well though somewhat weak and anæmic. Pulse 80, no exophthalmos; no goitre; neck 12 inches in circumference; hæmaglobin 85 per cent. A slight relapse occurred in July, 1908, but was checked by a repetition of the injections. Another slight exacerbation of subjective symptoms in October, 1908, was checked within one week by giving one-fiftieth of a grain of sheep thyroid globulin by rectum every six hours. Since then there has been no recurrence and there is now no sign of disease.

CASE 114.—Mr. McG., aged 53, had had typical severe exophthalmic goitre seven years previously; under rest cures and a valetudinarian mode of life the disease had passed through the chronic stage and reached the myxœdematoid type in November, 1907. Exophthalmos slight, with puffiness about the eyelids and malar prominences; yellowish brown dry skin with dry, brittle hair on the scalp; puffy supraclavicular pads; stiffness of the fingers; small hard goitre; pulse rate 120–130 on exertion, 90–110 while at rest; apparent general good nutrition but complains bitterly of nervousness, tremor, insomnia, weakness and fermentative indigestion. An experimental injection of thyroid antiserum produced great prostration and diarrhœa and intensification of all symptoms. After an interval during which recovery to the previous condition occurred, the sheep thyroid nucleoproteid and globulin were tried by mouth without benefit and with an increase in pulse rate and some diarrhœa. Again after another interval the human thyroid globulin solution was tried without benefit except some improvement in the gastro-enteric symptoms; but with this there occurred an exaggeration of the nervous excitability and insomnia and the pulse rate was no better. The normal human thyroid nucleoproteid solution was then tried with no ill effect and some immediate improvement in the insomnia. The dose of this 1 : 1000 solution had to be kept at not over 5 minims

once a day, as increasing it produced tachycardia; but by perseverance a gradual steady improvement in all symptoms took place until in March, 1908, the myxœdematoid signs had practically disappeared and the pulse after a brisk walk was between 80 and 90. The only evidence of disease was a considerable weakness and inability to withstand ordinary fatigue. This patient relapsed several times subsequently, always beginning with a gastro-enteritis apparently produced by eating heartily when fatigued, and each relapse has been checked and corrected by the same normal human thyroid nucleoproteid injections.

These relapses caused him to seek other assistance and in August, 1908, three of the thyroid vessels were ligated under local anæsthesia by Prof. Kocher in Berne. There was a stormy convalescence, according to the patient's report, and no appreciable improvement. Benefit with the thyroid nucleoproteid was then again obtained, but another relapse preceded by tonsillitis and gastro-enteritis occurred in September, 1909. This was followed by evidences of severe nephritis accompanied by albumin, casts and blood in the urine, but all the signs of thyroidism disappeared. Death followed in uræmic coma, in November.

This terminal nephritis is much more common than glycosuria and seems about equally fatal.

CASE 287.—Miss R., age 31, had always been "nervous" and subject to "bilious" attacks. In November, 1908, she presented mild typical symptoms of exophthalmic goitre which had been gradually becoming more noticeable during the previous year. Exophthalmos was very slight. There was a small firm goitre; pulse rate 120; well-marked tremor and extreme nervous excitability. Hæmoglobin 85 per cent., leucocytes 9000, lymphocytes 32 per cent. From November, 1908, to March, 1909, first the antiserum and then prothyroid treatment combined with pancreas feeding produced very slight improvement. On March 12, 1909, the superior thyroid vessels were tied under nitrous oxide—oxygen anæsthesia—with almost immediate benefit, especially in the nervous excitability. The pulse rate instead of averaging 110 dropped to 90 and the previous frequent exacerbations of thyroidism ceased. The preparations of pancreas were then administered. Trypsin or holadin seemed to excite headache almost immediately; pancreatin or pancreatic extract seemed to cause over-action of the heart with a subjective sensation of thumping but no appreciable increase of pulse rate; the pancreas nucleo-

proteid, however, given in one-half grain doses three or four times daily appeared to increase the strength and weight, and there was a gain of 15 pounds soon after it was begun. The combined thyroid proteids before the operation always excited the pulse rate. A few weeks after the ligation of the vessels the combined thyroid proteids were given with the pancreas nucleoproteid and seemed beneficial. In June, 1909, the pulse rate averaged while at rest 80-90; the blood examination was normal; there was no exophthalmos; and the goitre was appreciably softer and smaller, although the neck measurement showed no change because of the gain in flesh. This patient still shows signs of the disease in the nervousness and easily excited tachycardia, and so is classified as only improved.

CASE 210.—Miss C., aged 22, presented typical severe exophthalmic goitre of about six months' duration. There was excessive nervous irritability and insomnia and only a slight change for the better could be noted after two weeks' trial with the antiserum. On July 24, 1908, the right or larger thyroid lobe and the isthmus were therefore removed under ether. Recovery was uneventful and at the end of a week the subjective distress and insomnia had disappeared. After four weeks in bed there was no discoverable abnormality except the cicatrix and slightly enlarged left lobe. In October, 1908, this patient returned to Finland for a year's rest and now appears perfectly normal.

CASE 23.—Miss M., age 28, presents typical symptoms of exophthalmic goitre of about two years' duration; firm symmetrical goitre; moderate exophthalmos; pulse rate 120-140; moist skin; blood and urine examination negative.

On March 17, 1906, I watched the removal of nearly the entire thyroid gland. A portion representing about one-half gram of tissue at the upper end of the right lobe was left and was apparently supplied by a small branch of the corresponding superior thyroid artery. The operation was performed quickly and well and no unusual traumatism was inflicted upon the excised gland. This patient left the table with only a slightly increased pulse rate, but it rapidly rose and was accompanied by high fever, great restlessness and nervous excitability. At midnight a considerable dose of a potent antiserum was administered; but though a careful watch was kept upon the pulse rate no change could be detected and the patient died about 24 hours after the operation with a pulse which had steadily increased in frequency and weak-

ness. The temperature reached 105, respiration 40 and labored, and extreme nervous excitability and delirium.

Was this a death from thyroidism or from an over-acting and self-activating chromaffin system?

CASE 143.—Mr. C., age 62, in February, 1908, presented typical exophthalmic goitre of about two years' duration. The goitre and other symptoms had been first noted after a severe operation for gall-stones. It was firm, elastic and symmetrical; greatest circumference of neck 16 inches; noticeable exophthalmos; pulse rate 100-120 and somewhat irregular; skin moist, marked tremor and nervous excitability; blood and urine examination was negative. The antiserum was first tried and produced so much prostration without noticeable improvement that it was not repeated. The combined thyroid proteids intensified all the symptoms. Iodine was then administered in the form of one grain iodide of iron pills given after meals, and an almost immediate subjective and objective gain became apparent. On April 15, 1908, he had gained on this medication alone 22 pounds; the pulse rate was 72; there was no exophthalmos and no goitre; the neck measured 15 inches in its greatest circumference; there was no sign of disease and there has been no relapse.

CASE 420.—Mrs. G., age 35, presented severe typical exophthalmic goitre in the later stages although the disease had been recognized only during about one year. She had received the antithyroid serum elsewhere and at first been benefited but continued at work, and in August, 1909, the disease compelled rest in bed in Bellevue Hospital. There was a large, firm symmetrical goitre; greatest circumference of neck 15 inches; pronounced exophthalmos; respiration 28-30; pulse rate 120-140; hæmoglobin 90 per cent.; leucocytes 11000; lymphocytes 28 per cent. of this; blood pressure 150 mm. Hg; noticeable pigmentation or bronzing of the skin which was like that of advanced Addison's disease; a cutaneous test for tuberculosis proved negative; great emaciation and weakness. The antiserum was tried and intensified all the symptoms although there was a transient drop in the pulse rate and respiration about 12 hours after the injection. The thyroid proteids proved equally useless or injurious. Pancreas feeding proved negative. On August 12, 1909, the subcutaneous administration of 10 minims of a 1:1000 solution of (human) adrenal nucleoproteid material was begun and continued once in 12 hours and was followed by an almost immediate improvement. On

August 18 the blood pressure was 110 mm. Hg; the pulse rate 80-90; respiration 22-24; leucocytes 9000 and lymphocytes 18 per cent. of this; the goitre was softer and smaller; greatest circumference of neck 14 inches; eyes less prominent and the cutaneous pigmentation had noticeably faded. She then insisted on returning to her home and I have since heard she has relapsed as was to be expected. The important facts in this case were the suggestion of suprarenal disease in the cutaneous bronzing; the high blood pressure; and the relief of this and other symptoms by the adrenal nucleoproteid alone.

CASE 315.—Miss D. B., aged 17, always a delicate, nervous child, began to show the unmistakable signs of exophthalmic goitre after the death of her father and during a period of hard study six months ago. Under a careful regimen of rest in bed for half the day the widening of the palpebral fissure, the slight goitre and pulse rate of 110-120 at least did not increase.

In February, 1909, she was placed upon one-fiftieth grain of thyroglobulin by rectum three times daily and showed a slight improvement in the course of two months. In April the pulse ranged between 90 and 100, the goitre was smaller and softer and the eyes normal but tachycardia was easily excited by emotion or fatigue and there was some fermentative indigestion. On May 3 the thyroglobulin was stopped and a suppository containing five grains of trypsin was given by rectum morning and night. When arising on the day following this change the pulse which had not been below 90 for months, was counted at 62, and later without rising in rapidity became somewhat irregular. The dose of trypsin was then reduced to three grains twice daily and though the pulse continued at 75 at the end of a week slight enlargement of the thyroid was noted and the medication was changed to one-fiftieth grain of the combined thyroid proteids by mouth in protected capsules three times daily. Under this treatment the goitre and other symptoms gradually disappeared and at present there is no sign of disease.

The noticeable feature in this case was the marked and immediate effect of trypsin upon the tachycardia.

CASE 151.—Mr. P., age 44, gave a history of having been treated for "diabetes" and apparently cured in 1904. In October, 1907, he began to suffer from typical exophthalmic goitre and in November showed in addition a noticeable bronzing of the skin. Between November, 1907, and February, 1908, he was

treated first with the antithyroid serum and later with the administration of the combined thyroid proteids and finally iodine alone; the symptoms disappeared with the exception of a goitre of the right thyroid lobe, some weakness and the cutaneous pigmentation or bronzing. In March, 1909, after a period of hard work as a travelling salesman the symptoms of Graves's disease recurred with considerable enlargement of the thyroid, a deepening of the pigmentation and polyuria in which there was 1 per cent. of glucose. The antiserum checked all the objective symptoms and decreased the glycosuria to about 0.1 per cent., but great prostration and weakness followed. April 12, 1909, under nitrous oxide and oxygen anæsthesia, the right or more enlarged lobe and isthmus of the thyroid were excised. Recovery was uneventful and there was a prompt subsidence of the thyroidism, and though the percentage of glucose rose to 0.5 per cent. at first, at the end of five days it had disappeared. Later, when out of bed, traces of glucose could be detected from time to time and various preparations of pancreas were administered by rectum. It was remarkable that all except trypsin produced promptly a feeling of heart thumping and constriction of the neck, and with this there was some acceleration of the pulse and perceptible swelling of the remaining left thyroid lobe. But 5 grains of trypsin given in suppository three times, then twice, daily, seemed to relieve the subjective symptoms, slow the pulse and soften the goitre. Furthermore, the trace of glycosuria promptly disappeared under its administration. This medication and all restraint in diet (sugar alone had previously been abstained from) was abandoned in July, as every sign of disease except some bronzing of the skin had subsided, but in August he complained of some "rheumatism" or neuralgic pains in the legs and a slight increase in the size of the thyroid and in the rapidity of the pulse rate (90), and 0.5 per cent. of glucose was again found in the urine. Three grains of trypsin were then given by mouth in protected capsules and a diet (excluding sugar only) was instituted and the condition returned to normal within five days. At present (September, 1909) there is no goitre nor exophthalmos, the pulse rate averages 76-80 but the color of the skin is noticeably darker than it should be; there is no glycosuria nor polyuria.

CASE 43.—Miss N. B., aged 28, noted the first typical symptoms of exophthalmic goitre in January, 1905, while serving her novitiate as a trained nurse. In June, 1906, the condition was

that of rather severe Graves's disease; pulse 130-150; pronounced exophthalmos; large goitre and emaciation. Under antiserum treatment she had entirely recovered in December and gained 40 pounds in weight. She remained without sign of disease until May, 1909, when there developed quite suddenly polyuria amounting to about 80 ounces in 24 hours; marked thirst and 7 per cent. glucose and considerable acetone and diacetic acid were present. Strict diet was instituted and 30 grains of a pancreatic preparation (holadin) in protected capsules was given daily in divided doses. There was an immediate improvement in all symptoms. There had been and were none of thyroidism and the pulse rate averaged 60-65, and on June seventh 40 ounces of urine were passed without any trace of glucose. Experiment showed that both the strict diet and the pancreatic feeding (in protected capsules or by rectum) were necessary to maintain the freedom from glycosuria. Without the pancreatic feeding traces of sugar and polyuria become apparent within 24 hours even if the strictest diet was maintained. About 6 grains daily of the pancreas nucleoproteid given by rectum seemed as efficient as 30 grains of the holadin preparation. After a period of rest and good hygiene combined with strict diet and the pancreas feeding she had no symptoms and resumed work as a trained nurse about August 1. On September 9 she returned and for the past few days had voided an average of 130 ounces of urine daily. The examination showed a specific gravity of 1040 and approximately 5 per cent. glucose. Rest, strict diet and pancreas feeding made no appreciable improvement and she rapidly lost ground and died in diabetic coma on September 30.

NOTE.—In previous communications on this subject which included a theory for the function of the thyroid gland, its secretion was supposed as above to possess two elements, one the nucleo proteid, to directly stimulate the cardiac and respiratory centres in the medulla, and the other the thyroid globulin to stimulate or activate all other organs and tissues. But this universally activating property of the thyroid globulin was supposed to exert its effects through the control of oxidation in which the thyroid globulin played the part of an oxidative enzyme or, in its ultimate analysis, a substance lying between the oxygen of the air and the hæmoglobin of the red corpuscles. This is too radical a departure from the accepted teachings of physiology to be advanced without more proof, and although there are some grounds for connecting the thyroid with oxidation, it is probably less erroneous to consider the thyroid globulin or colloid material as possessing generally "activating" properties rather than as governing some specific chemical process.

SUGGESTIONS FOR THE OPERATIVE CORRECTION OF SYPHILITIC AND OTHER DEFORMITIES OF THE NOSE.*

BY JOHN B. ROBERTS, M.D.,
OF PHILADELPHIA.

THE surgery of the external nose deserves more attention than is usually given it. The cosmetic value of the organ is very great and the possibilities of relief in cases of deformity are apparently not appreciated to their full extent by the medical profession or the public. The satisfaction often evinced by patients after seeing the facial improvement obtained by slight operations and the patience with which others will submit to a series of complicated and painful procedures are evidence of the importance of this kind of surgical endeavor. Very much can be gained by operative reconstructions without resort to bizarre methods.

Congenital absence of the nose is a rare deformity which may require surgical attention if the infant survive the early periods of human life. Congenital fissure of the nose may also need plastic repair.

The most common congenital defect of the external nose is the broadening of the nostril, due to spreading of the ala, found in connection with harelip and cleft palate. This deformity is to be modified by very early operation upon the cleft in the bony roof of the mouth, combined with a later plastic adjustment of the alar cartilage and upper lip. Careful correction of the nasal deformity is often neglected by operators on clefts of the upper lip.

Punitive losses of the external nose were common in the ancient and mediæval worlds and are still frequent in oriental countries. Such traumatisms concern as a rule only the in-

* Read before the American Surgical Association, June 4, 1909.

tegument and cartilages below the nasal bones. Hence they are repaired by plastic operations more easily and satisfactorily than deformities resulting from syphilis, gunshot injuries, or extensive operations for tumors. These causes of disfigurement often involve the bony and cartilaginous structures within the nasal chambers as well as the projecting external nose. When the nasal bones constituting the bridge of the nose have been lost or the supports of the external cartilaginous nose have been destroyed by syphilis, the reconstructive problem is much more difficult than when the cartilaginous nose has been merely sliced off by the sword of an antagonist or the knife of an avenger.

The inherent trouble in all extensive nasal reconstructions is the obtaining of sufficient permanent projection from the surface of the face. It is an easy task to put a flat mass of skin and fascia in the region of the nose. It may be not very difficult to give it the prominence and general shape of a nasal organ. To maintain permanently the shape and prominence of the new nose, despite the contracting power of scar tissue, is the surgeon's difficulty. To obtain nares which will remain patent and a columella which will resist deformity from postoperative contraction is often almost impossible. When the ulcerative process of syphilis, tuberculosis or malignant disease or when gangrene from burns, frost-bite or caustics has destroyed the cutaneous surface around the nose, it becomes necessary for the surgeon to transfer or transplant healthy tissues from other regions to replace the scar tissue.

It is gratifying to find that inherited syphilis of the nose seems to be less apt to involve the skin than the acquired disease. Unfortunately both forms of this loathsome affection destroy the bones and cartilages, upon which the contour of the external nose depends. Much nasal deformity and mental suffering may be avoided by the early recognition of syphilitic lesions of the nose and the prompt institution of efficient specific treatment. I have never been convinced of the propriety of waiting for the development of secondary lesions before treating suspicious sores with mercury; nor can I

FIG. 1.



Congenital absence of external nose associated with double harelip and cleft palate. No nostrils and no evidence of external nose were present except a slight elevation below the frontal spine, which was evidently the two nasal bones. Child died when a few days old. (Patient of Dr. Delno E. Kercher.)

FIG. 2, a.

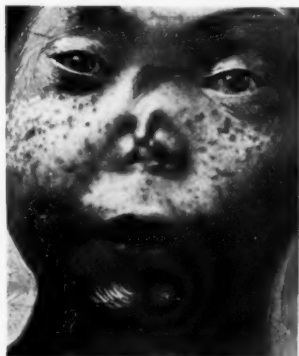


FIG. 2, b.



Photographs of a sunken nose from necrosis of cartilages and internal bones in infancy improved by operation. (J. B. Roberts.)

FIG. 3.



Method of correcting a sunken syphilitic nose of moderate severity.

FIG. 4.



Lateral view of patient operated on by method shown in Fig. 3.

FIG. 8.



Photograph of a patient operated upon by Major Henry Smith, of the Indian Medical Service, by his modification of Keegan's method. (Courtesy of Col. D. F. Keegan, M.D.)

understand the folly of treating tertiary lesions with small and therefore inefficient doses of mercury and potassium iodide.

Deformities of the nose and obstructions to proper ventilation of the nasal chambers and to respiration will be much lessened in number, if, after blows and falls upon the face, children and others are carefully examined for fractures and dislocations of the nasal bones and cartilages. The early reduction of displaced structures will prevent disfigurements, which may not offend the eye till swelling has disappeared or the child has increased in age. Portions of the nose accidentally cut off should be immediately replaced and sutured after aseptic cleansing. Their permanent union may sometimes be obtained, if the parts are kept warm.

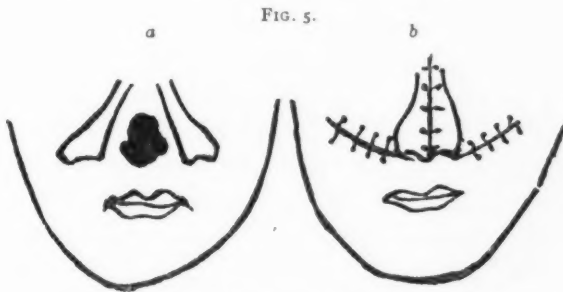


FIG. 5.
Serre's method of rhinoplasty, occasionally available.

Rhinoplastic operations are important because of the cosmetic value of a comely nose. The psychic effect of a knowledge of marked facial disfigurement, especially if due to syphilis, is sufficient to affect the patient deleteriously in both disposition and earning capacity. Suits to recover damages for nasal disfigurement indicate that a distinct commercial value is attached to comeliness of countenance.

Total rhinoplasty should mean reconstruction of the whole nose below the frontonasal suture, but the term is often used when the loss of the organ begins below the nasal bones. Pedunculated flaps for the reconstruction may be taken from the patient's arm, forehead or cheeks. Brachial flaps require

the arm and the head to be held in apposition by gypsum bandages or other retentive apparatus for about two weeks. A flap cut on the upper arm or forearm may be permitted with advantage to contract and thicken by cicatricial changes or be moulded somewhat into shape before the arm and head are approximated and the flap sutured in the nasal region. Lexer¹ has carved a nose from the condyles of an amputated femur, bored holes for nostrils, planted the bony mass under the skin of the forearm and subsequently transplanted it upon the face.

The frontal method has the advantages that it requires no restraint in the patient's posture and that strips of periosteum or bone cut with the flap from the forehead may be imbedded in the new nose with comparative ease and considerable advantage. There are numerous modifications of these osteoplastic methods. The scarring of the frontal region is a disadvantage, but this may be minimized by aseptic methods and skin grafting.

In partial rhinoplasty pedunculated flaps are often taken from the cheeks. If cut in the direction of the nasolabial furrows such flaps, even when large, leave comparatively little objectionable scarring. The incidental diminution of the prominence of the cheeks increases the relative projection of the plastic reconstruction of the nose and is therefore a cosmetic benefit.

Superimposed flaps may be necessary in nasal reparations, in order to give to the structures sufficient thickness and rigidity to retain nasal projection.

Free flaps of integument from the inner surface of the thigh or arm may be utilized, if careful asepsis is obtained and maintained during the transplantation and after dressing. Such nonpedunculated flaps cannot be used with much hope of success, when the raw surfaces or edges are subjected to direct communication with the nasal chambers. Infection is then too probable.

¹ Lexer, *Verhandl. der Deutsch. Gesell. für Chirurgie.*, 1908, ii.

Portions of cartilage taken from the patient's ribs or ear, pieces of bone from the forehead, tibia, ulna, ilium, a finger or a toe, or strips of bone or periosteum from a rabbit's femur may be implanted in the soft tissues used to repair the nose. These if aseptic become incorporated and may give permanent rigidity to the newly made nose. Such organic implantations are preferable to inorganic implantations or supports of celluloid or metal.

Improvement in shape of sunken or saddle noses may be obtained by the injection under the integument of paraffin or

FIG. 6.

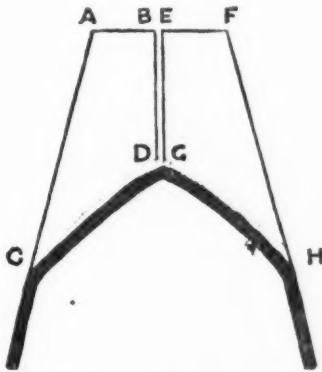


FIG. 7.

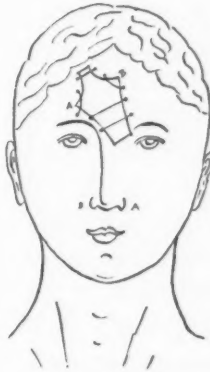


FIG. 6.—Diagram of Keegan's operation for rhinoplasty. The flaps C A B D and G E F H are dissected from surface of nasal bones and bent downward as if on hinges at C D and G H.

FIG. 7.—D. F. Keegan's method of cutting the frontal flap and applying the sutures to the frontal wound. (From Keegan's Rhinoplastic Operations.)

paraffin mixed with other materials. This wax-like material may be injected while hot enough to be fluid and then moulded with the operator's fingers into the desired form before it has time to cool. I use material with a melting point of about 110° F. A good hypodermic syringe with a rather large needle is all that is necessary for this little operation. Careful asepsis is essential and great care should be taken not to implant too much paraffin. It must be injected under, not into, the skin. Embolism of the artery of the optic nerve, sloughing of the skin and other mishaps from this little rhinoplastic

operation must be remembered as possibilities, and be carefully avoided.

The method of Keegan, whose service in India gave unusual opportunity for practical experience in dealing with mutilations of the nose, is probably the best rhinoplastic operation, when the nasal bones and the skin covering them have been preserved.

The operator first dissects from above downwards two flaps from the surface of the nasal bones and turns these down as on a hinge situated above the lower border of the bony nasal bridge. This gives a cutaneous surface towards the open nasal chambers and a raw surface from the root of the nose to its proposed tip.

An oblique frontal flap is then cut with its pedicle near the inner canthus of one eye, so that it may be nourished by the angular artery. The alæ and columella are provided for in forming this flap.

The size and exact shape of this frontal flap have been previously determined by cutting a piece of a flexible leaf to meet the special requirements of the deformity. This is copied in paper and the paper fastened to the skin of the forehead, before the knife, which marks out the flaps, is used. The flap is then raised, its pedicle twisted, and sutures are used to fasten it over the bared nasal bones and the turned down flaps covering the opening into the nose. A pit is made above the middle of the upper lip to receive the projection forming the columella, and the wounds on the side of the nose are deepened and lengthened to receive the edge of the flap from the forehead. The frontal wound is closed by sutures and with grafts made from any excess of tissue removed from the nasal or frontal flaps. Drain tubes are kept in the nostrils for a few days to maintain patency. The pedicle is divided in ten or fourteen days.

Instead of trimming away the median margins of the everted nasal flaps, which are voluminous, Henry Smith splits the remains of the nasal septum, inverts these median edges into the nasal cavity, and stitches them to the respective sides

of the split septum. He thus creates a new septum and columella, and lines more of the interior of the new nose with skin.

If the septum and columella thus made are not sufficiently rigid a strip of cartilage, cut from the end of one of the patient's costal cartilages, may be subsequently thrust into the new partition to correct its flaccidity.

FIG. 9.



FIG. 10.

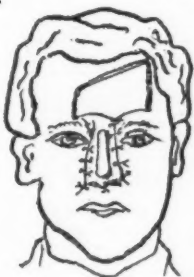


FIG. 11.

FIG. 9.—Charles Nélaton's method of giving rigidity to the frontal flap by previous implantation of a piece of the eighth costal cartilage under the periosteum of the forehead.

FIG. 10.—Eversion and modelling of the frontal flap in Nélaton's method.

FIG. 11.—The new nose, formed from a frontal flap and implanted cartilage, sutured to the cheeks and lip. (*La Rhinoplastie*, Nélaton and Ombredanne.)

A valuable method of rhinoplasty is that of Charles Nélaton. He excises nearly the entire length of the cartilage of the eighth left rib, and trims its end, for about 2.5 centimetres, down to a thickness of 3 millimetres. This strip of cartilage he notches where it is expected to make the point of the nose. Then he thrusts it into a horizontal tunnel between the bone and periosteum of the forehead. In two months the cartilage becomes vitally connected with the sur-

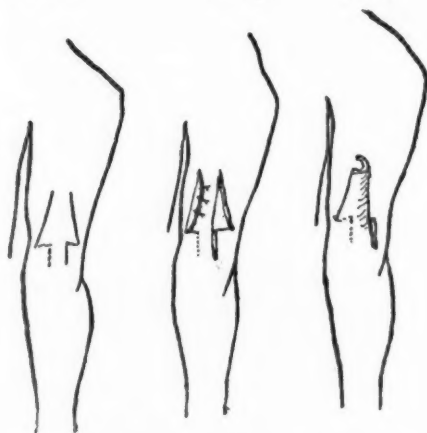
rounding tissues. The cicatricial borders of the nasal stump are then pared loose, making three flaps. These are turned downwards and inwards, and are sutured together so as to close more or less completely the upper part of the gap left by the loss of the external nose. The raw surface of these flaps presents forwards.

An irregularly quadrilateral flap is then cut from the forehead, with its pedicle at the inner border at the right eyebrow, containing the transplanted costal cartilage in its middle line. This flap is raised from the bone, carrying with

FIG. 12.

FIG. 13.

FIG. 14.



Dieffenbach's method of modelling brachial flap before transferring it to the face.

it the entire periosteum and the implanted costal cartilage. It is twisted downwards and sutured on top of the nasal flaps just mentioned. By appropriate modelling with stitches an acceptable nose with alæ, columella and nostrils is formed.

The frontal bone may lose a thin layer of its surface by necrosis, because its periosteum has been removed; but when granulation has occurred Thiersch skin grafts are applied and the final scarring is said to be not very deforming.

In brachial rhinoplasty the flap for the new nose may be cut from the upper arm or the forearm; or a pedunculated flap from the chest or abdomen may be grafted upon the

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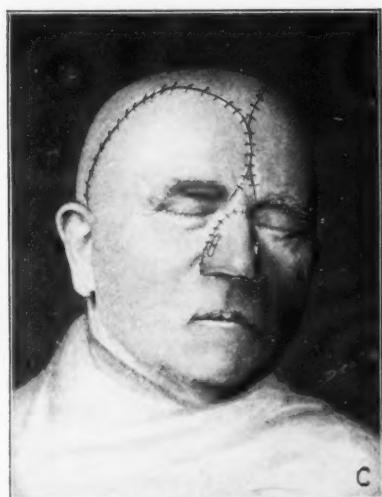
FIG. 15.



FIG. 16.



FIG. 17.



FIGS. 15, 16, AND 17.—Schimmelbusch's total rhinoplasty by means of an osteoplastic frontal flap, followed by lateral sliding of the skin of the temporal region toward the middle line. Triangular areas of skin are removed at 1 in Fig. 15 to permit apposition of the displaced temporal integuments. The new columella is made from the remains of the alæ as shown in Figs. 15 and 16. In Fig. 17 the reconstruction is shown as it appears after the sutures have been applied. (Fowler's Surgery, vol. i, p. 113.)

FIG. 18.

a



b



Rhinoplastic restoration of the alæ and lobule of the nose by a frontal flap. *a*, Before operation; *b*, Several years after operation. (Dr. Wm. G. Porter's case, from photographs.)

arm and subsequently applied to the nasal region, just as if it had originally been formed from brachial tissues. The retentive apparatus to hold the arm close to the face may be made from bandages and gypsum or from leather and webbing. The patient may be fitted with such appliances and wear them for a time prior to operation, in order to become inured to the discomfort due to their use. The brachial

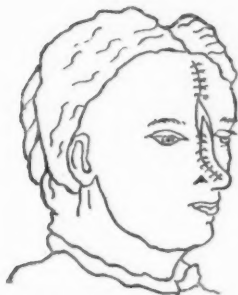
FIG. 19.



FIG. 20.



FIG. 21.



Charles Nélaton's method of osteoplastic rhinoplasty in partial loss of the external nose.
(*La Rhinoplastie*, Nélaton and Ombredanne.)

method is of more value probably, when partial rhinoplasty is to be done; because it scarcely ever can give sufficient rigidity to form an acceptable organ in total rhinoplasty.

Schimmelbusch has devised a method in which he uses a large osteoplastic flap from the forehead and slides large areas of the scalp from the temporal regions to cover the denuded space. The bony flap is covered with Thiersch grafts and then reversed.

Some operators have employed both frontal and brachial flaps, superimposing one upon the other.

The method described by Cheyne and Burghard may be found valuable in some cases of saddle nose.

For the various deformities requiring partial rhinoplasties there are almost innumerable operative devices.

In subtotal loss of the organ Charles Nélaton has sawed a long A-shape flap from the forehead and nasal margins, containing a plate of bone from the frontal bone and edges of the nasal and superior maxillary bones. This osteoplastic A-shape flap is slipped downwards and bent into shape to make a nose in the nasal region.

FIG. 22.

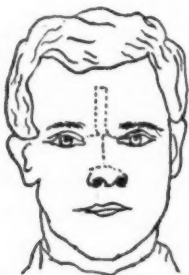
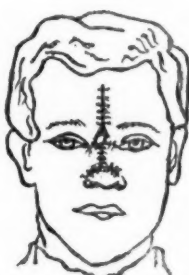


FIG. 23.



Restoration of the bridge of the nose by insertion of a strip of integument, periosteum and bone, from the middle frontal region, under the dorsal structures of the nose. (Cheyne and Burghard.)

Bardenheuer has devised a support for the anterior part of a new nose by incising the osteocartilaginous septum, if any remains, and turning forward a triangular flap, which projects beyond the plane of the face. On this support cellulocutaneous flaps are placed.

The so-called saddle nose, with its concave dorsum, elevated tip and nostrils presenting forwards instead of downwards, may need correction. It is apparently produced by an insufficient development of the nasal chambers and the nasal bones and cartilages. Moderate deformity of the kind is best corrected by injecting liquefied or soft paraffin, or paraffin and rubber under the skin with a syringe and hollow needle.

As the overlying structures on the bridge of the nose are often distensible, pieces of cartilage, celluloid or bone properly trimmed may be slipped under the skin, through a small incision, to fill up the hollow. The more pronounced instances may be remedied by splitting off pieces of bone at the lateral margins of the pyriform nasal opening in the skull, loosening them above, and pressing them towards the middle line. This raises the nasal bridge. They may be detached from their normal bony connections with small chisels introduced submucously or subcutaneously. The new raised position may be maintained till healing by transfixing the nose underneath

FIG. 24.

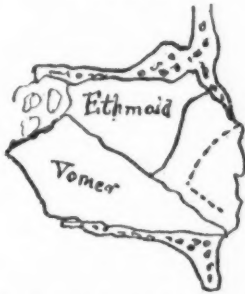


FIG. 25.



Bardenheuer's use of the anterior part of the cartilaginous and ethmoid septum as a support for the new nose made from the softer tissues. (Verhand. der Gesellschaft für Chirurgie, xxiv, i, 134.)

them with a steel pin. Rubber pads or shot on the ends of the pin lessen the likelihood of displacement. Properly fitted external clamps may be used for a few days instead of pins.

Noses in which depression of the bridge is great and especially those in which the skin is bound down, by old inflammatory adhesions, demand radical operative procedures. The sunken noses of syphilis with adhesions between the skin and the remains of the destroyed internal structures of the nose belong to this class. These distressingly ugly noses often have a sharply defined transverse groove across the middle of the sunken area; and the adherent integument is practically indistensible from cicatricial fibrous change. The term sunken nose is more applicable than saddle nose. In some of these

cases the skin of the nose should be detached from the bones by an inverted U incision and a frontal flap turned down and tucked under it. A piece of cartilage or bone may be incorporated in or between these superimposed flaps. Occasionally the tissues may be satisfactorily raised by undermin-

FIG. 26.



FIG. 27.

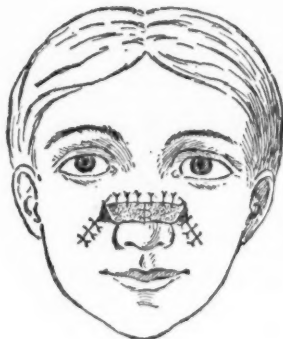


FIG. 28.

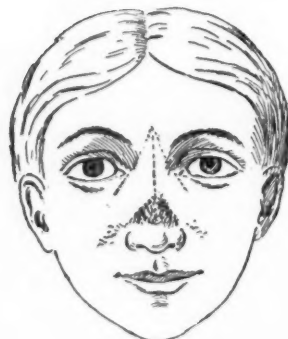
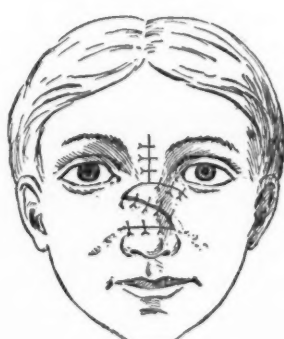


FIG. 29.



Roberts's method of operating upon the sunken nose of syphilis by superimposed flaps from cheek and nasofrontal regions.

ing the skin with a tenotome and injecting semi-solid paraffin.

The worst forms of syphilitic sunken nose require still more extensive operative reconstructions. The first step should be a deep cut across the sunken region in the transverse groove. This incision opens the nasal cavity and permits the lobule and alæ to be displaced downwards and forwards into

the normal position. This manœuvre restores the prominence of the tip, or lobule, and makes the nostrils again lie in the horizontal plane. The next step is to fill the gaping opening

FIG. 30.

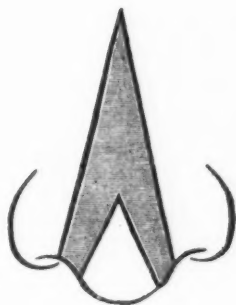


FIG. 31.

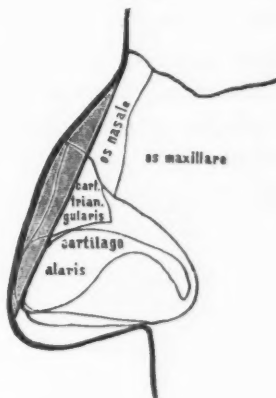
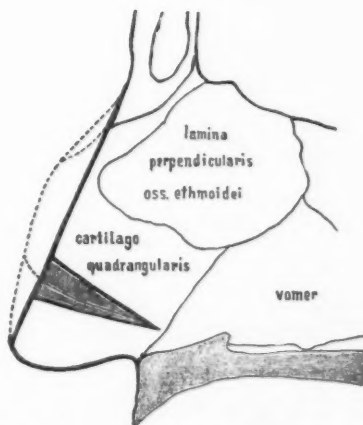


FIG. 32.



Jacques Joseph's method of diminishing the size of a giant nose. (*Berliner klin. Wochens.*, 1898, No. 40, and *Deutsch. medicin. Wochens.*, 1904, No. 30.)

between the lower margin of the bony bridge above and the replaced lobule and alæ below. The tissues used to close this large orifice must be permanently thick and rigid. Flaps may be taken from the forehead, or cheeks, or preferably from both.

I devised some years ago a method which answers well. The first stage consists in cutting a flap from each cheek near the naso-labial furrow. These are turned upward and inward to meet in the median line and thus cover in the opening. The skin surface is towards the nasal chamber. After these flaps have been united and cicatrized, the irregularities at their base are corrected by incisions and sutures. The next major procedure is to make an inverted V incision, from the middle of the forehead, the legs of which run downwards and outwards to points on the cheeks below the eyes. Just above the granulating surface on the former flaps, which closed the

FIG. 36.



FIG. 37.



Lobule, columella and alæ formed from flaps cut from lower part of the cheeks. At a later operation the base of the flaps are cut and the alæ are set nearer the columella to make proper nostrils. Bayer-Payr's method. (*Deutsch. Zeitsch. für Chirurgie*, Bd. ix 1901, 142.)

opening, a similar inverted V-shape cut is made. The apices of these two cuts are joined by a vertical incision in the middle line. This series of incisions marks out two rhomboidal flaps with their pedicles on the cheeks close to the sides of the nose. These flaps are then raised from the frontal and nasal bones and turned downwards over the cicatricial or granulating surface of the reversed cheek flaps, previously used to close the opening into the nasal chambers. The upper angle of the right flap is sutured to the base of the left alæ and that of the left flap is turned so as to reach across to a point near the inner canthus of the right eye. Sutures are employed to maintain the new relations of the frontonasal flaps, which have been laid upon the overturned cheek flaps; and the wound on

FIG. 33.



FIG. 34.

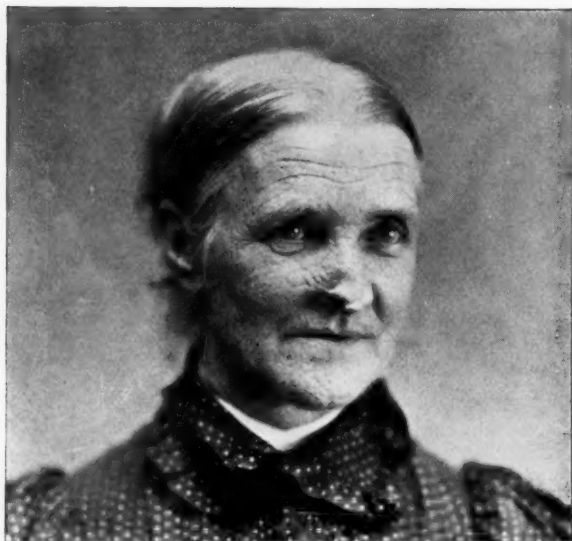


FIG. 35.



FIGS. 33, 34, AND 35.—Photographs of a case of restoration of the end of the nose by flaps taken from the cheeks. (Roberts.)

FIG. 38.



Ala repaired by attaching the finger tip to the nose and later cutting the finger loose.
Dr. J. P. Tunis. (Roberts's Deformities of the Face.)

FIG. 39.



Ala made by flap from cheek. Secondary modelling operations were performed later.
(Roberts's Deformities of the Face.)

the forehead is easily closed in a vertical direction. The scars are inconspicuous, and much rigidity is given to the tissue interpolated between the root of the nose and its lobule. The internal surface of the interpolation is lined with skin and so is the external.

A very large nose may be successfully reduced in size by an operation devised by Jacques K. Joseph. His operation

FIG. 40.

FIG. 41.

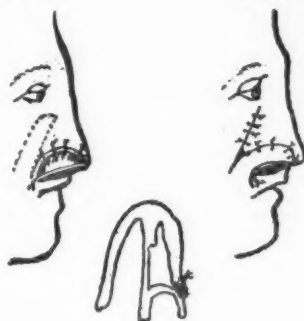
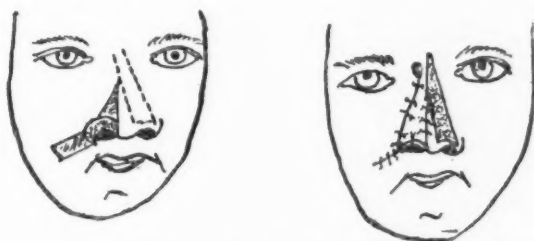


FIG. 42.

Henry Thompson. (Dublin Hospital Gazette, August 15, 1855, p. 212.)

FIG. 43.

FIG. 44.



Operation for restoring ala of nose. (von Hacker, Beiträge zur klin. Chirurgie, 1897, xviii, p. 545.)

consists of three procedures, which are done at one sitting. The great width of the organ and the large nostrils are diminished by excision of an A-shape portion of integuments and cartilage on the anterolateral surface of the nose. Then the bony and cartilaginous roof is pared away with chisel and scalpel to reduce the prominence of the organ. Finally the nasal septum is shortened by cutting out a wedge with its

base forward and its point directed downwards and backwards. Careful suturing of these wounds converts a gigantic nose into a much smaller organ. Joseph's report says that his patient was much improved and greatly pleased with the change.

FIG. 45.

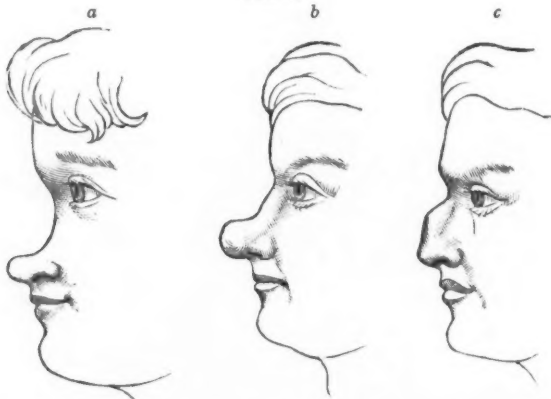


FIG. 46.



Jalaguier's method of treating cicatricial closure of nostril. A flap from upper lip is turned into nostril and stitched to inner wall of ala; then a flap from cheek is used to cover raw surfaces on septum, floor of nostril and upper lip. (Bull. Soc. de Chirurgie de Paris, 1902, p. 892.)

FIG. 47.



a, saddle nose; b, tubercous nose; c, angular nose. (From Roberts's Crooked and Otherwise Deformed Noses.)

For restoring the alæ or the lobule of the nose, lost by frost-bite, cauterization or excision, flaps may be taken from the cheeks, the lips or even the chin. In some instances pedunculated flaps from the arm or hand may be utilized, if the constrained posture of this procedure is not deemed undesirable.

The Bayer-Payr method cuts flaps from the sides of the chin and turns them up to make alæ and columella. The new alæ may be lined with mucous membrane dissected from the nasal septum or repaired with a flap from the cheek with the skin surface turned inwards. Thiersch grafts or small skin

FIG. 48.



Bent nose.

FIG. 49.



Twisted nose.

FIG. 50.



FIG. 51.



To lessen size of nose when soft parts are too bulky, as after plastic restoration. When bones and cartilages are gigantic the methods of Dr. Jacques Joseph are to be used.

flaps thrust through buttonholes in the skin may give aid in this endeavor. The alæ needs to be stiff enough not to collapse during inspiration. A slip of cartilage taken from the ear may be inserted, or scales of cartilage cut from the costal cartilages may be employed.

I have stiffened the columella of a soft nose by inserting a peg of cartilage cut from the tip of the eighth left costal cartilage. This gave the lobule the proper projection forwards. The columella may be made from two vertical flaps cut from the upper lip, one on each side of the median line, involving only a part of the thickness of the lip. The entire thickness of the upper lip may be similarly employed for a single median flap. Longitudinal labial flaps may be chosen, or the tissues between the thumb and forefinger may be grafted into the gap, by applying the hand to the chin for about two weeks. A portion of the nasal spine of the upper

FIG. 52.

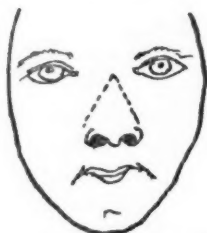
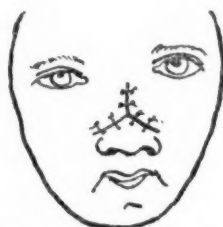


FIG. 53.



Dieffenbach's method of making a short nose longer and wider and restoring the nostrils to the horizontal plane.

jaw may be chiseled loose and reflected upwards to give rigidity to the new columella, which is to be constructed.

Atresia of the nostrils may be overcome by appropriate use of cutaneous and mucous flaps. Bent and twisted noses of various forms may be corrected by dividing the bones and cartilages thoroughly with saws and knives after loosening the soft parts subcutaneously with a tenotome. The deformity should then be overcorrected by removing interfering cartilage and bone. The new relations of the nasal structures must then be maintained for about ten days by means of pins or intranasal splints. Flat noses, short noses and large noses may be successfully modified.

Noses the seat of rhinoscleroma may be restored to a much more shapely condition by simply shaving off the excess of hypertrophic tissue.

RHINOPLASTY BY MEANS OF ONE OF THE FINGERS.

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OF CHARLOTTESVILLE, VA.,

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O. G., aged 24, farmer, was admitted to the University of Virginia Hospital on December 24, 1907, with the history of having been injured a few hours previously by the accidental discharge of a shotgun at close range. The load passed across the front of the face, tore away a portion of the left cheek, the anterior wall of the left antrum of Highmore and the greater portion of the nose, producing a ghastly wound (Figs. 1 and 2). The wound was somewhat triangular in shape, the apex of the triangle being at the outer margin of the left malar prominence, the base extending from the right internal angular process to within 1 cm. of the root of the right nostril. The left ala nasi was completely severed. The structures involved were the soft structures of the left cheek, the anterior wall of the antrum of Highmore—into which an opening 1 cm. in diameter was made—the soft structures of the nose from the glabella to within 1 cm. of the tip of the nose, the nasal bones, the cartilaginous and bony septum of the nose and the anterior quarter of the left inferior turbinate bone.

The wound was comparatively clean and granulated rapidly. It was proposed to him to restore the bridge of the nose by using one of the fingers, and then to cover in the openings upon either side of the finger by means of a flap from the arm in the manner that the canvas is stretched over the ridge pole of a tent. He readily consented.

January 15, 1908, the operation was begun. After dissecting up the columna of the nose and denuding the distal phalanx of the little finger of the left hand, the nail being removed and the matrix thoroughly destroyed to prevent further growth of the nail, the finger was inserted through the remnants of the nose and fixed to the skull with silver wire (Fig. 3). The arm was held in place by means of a plaster cast.

February 1, the finger was amputated under local anæsthesia (Fig. 4) and a few days later the end of the finger was trimmed off and the bone of the proximal phalanx removed in order to diminish the thickness of the septum and restore the size of the nostrils. The columna was then sutured in place over the end of the finger (Fig. 5).

February 14 the skin on the dorsum of the finger was removed and after dissecting up a flap from the right forearm this flap was sutured to the right margin of the nasal wound, the arm being again immobilized in a plaster cast (Fig. 6).

February 28 the flap was severed from the arm and its free edge sutured to the left margin of the nasal wound, covering the opening to the left of the finger.

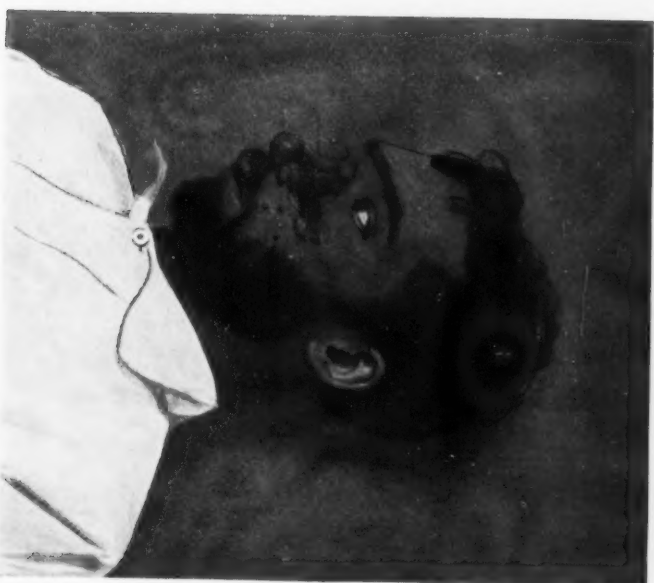
An excellent cosmetic (Fig. 7) and functional result was thus obtained.

FIG. 1.



Full view, showing destruction of bridge of nose.

FIG. 2.



Profile view.

FIG. 3.



Finger in position, wired to skull.

FIG. 4.



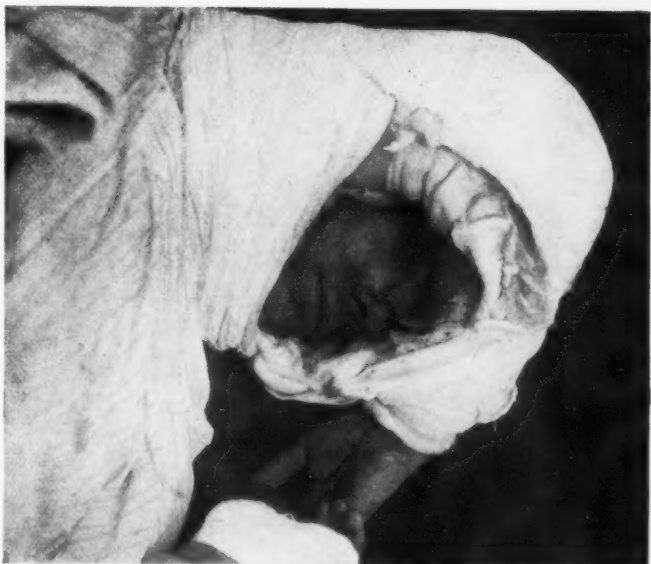
Finger severed from hand.

FIG. 5.



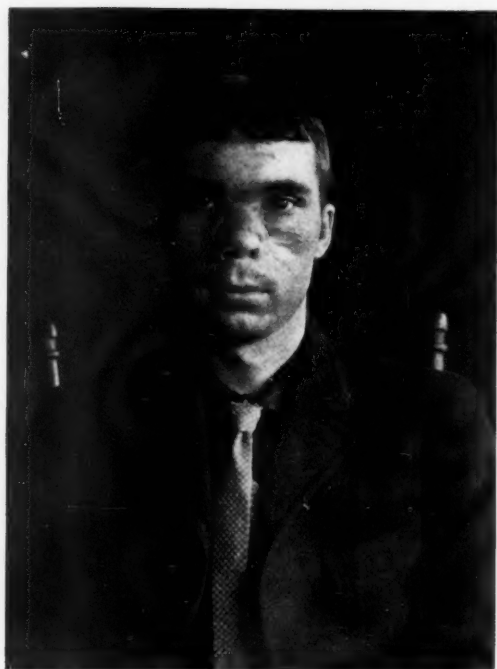
Finger trimmed up and septum sutured in place.

FIG. 6.



Covering finger with flap from arm.

FIG. 7



Final result.

TRAUMATIC LESIONS OF THE ATLAS AND AXIS.

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AND

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THERE exists much lack of knowledge concerning the subject of non-fatal injuries to the upper two cervical vertebræ. The matter was first called to our attention by the observation of a rather remarkable case and the interest thus aroused has led to the discovery of others and to a review of the literature. By considering the production of the injury and by describing the immediate and subsequent symptoms we hope to make their diagnosis more easy and their rational treatment and intelligent prognosis more clear.

Literature.—At least three important articles on the subject of injuries to the upper cervical vertebræ have appeared in recent years. The first is by Walton, in the *Boston Medical and Surgical Journal* in 1903, on "Cervical Dislocations and Their Reduction"; the second by Corner in the *ANNALS OF SURGERY* in 1907, on "Rotary Dislocations of the Atlas," and the third by Van Assen in the twenty-first volume of the "Zeitschrift für orthopädische Chirurgie."

Walton's article is the first clear description which we have found of the cervical dislocations and the rational method of their reduction. He believes them to be far commoner than has been supposed. They are usually unilateral and consist of a rotary displacement, the upper vertebræ on the side of the lesion slipping forward and either catching on the apex of

the articular process below or slipping over it into the intervertebral notch. These lesions are non-fatal, do not cause symptoms of compression of the cord, and are capable of reduction after long periods by proper manipulation.

Corner's article on "Rotary Dislocation of the Atlas" is comprehensive and attempts to cover the reported cases of fatal and non-fatal injuries to the atlas and axis. He calls attention to the fact that in order to allow the free motions of the head the ligaments are all lax, that the head therefore must be held firm by muscular action alone,—and that if for any reason this muscular support is lacking, any blow has, to use his words, a "flying start" in the production of the dislocation or its complicating fracture. From his cases it is evident that the most important point to determine as well as often the most difficult is the fracture or integrity of the odontoid process. In 6 of the 8 fatal cases of Corner the odontoid was broken. In the 10 non-fatal cases only once. It also is suggestive to realize that of his 8 fatal cases in only 2 did death or paralytic symptoms follow soon after the injury, periods varying from twenty-three days to several years elapsing in all the others, and that the cause of death at this time was either injudicious movements made by the patient or his physician or the development of a myelitis.

The last article which we shall review is one by Van Assen, from Joachimsthal's clinic, and primarily the report of a case of fracture of the posterior arch of the atlas and of the odontoid process with a probable accompanying rotary dislocation of the atlas on the axis. It is more than this, however, for he too attempts a review of the literature and brings out certain important facts. He reports a collection of 136 cases of spinal injury made by Wagner and Stolper, who found among these only 1 of injury to the atlas and axis. Out of 19 cases of injury to the atlas collected by Van Assen only 1 was diagnosed in the living and many of them were associated with lesions of other vertebræ. He states that only 6 authentic cases have been recorded of isolated fracture of the atlas. In the 12 reported cases of fracture of the axis 9 times the odon-

toid only was broken. It is seen, therefore, that reports of injury to the atlas alone are very rare, and that injuries to the axis alone or in conjunction with the atlas are not often recognized in the living.

Production of the Injury.—In general these lesions result from violence of some sort. Falls from a height or down stairs are commonest causes. In these cases the blow is received on the fore part of the head and from above downwards. In Dr. Wilson's case, reported in the ANNALS OF SURGERY, April, 1907, there is reason to believe that at least the final displacement was accomplished by an osteopath, who exerted in one of his manipulations quick forcible pressure on the top of the subject's head while he was standing. The patient immediately fell to the floor, but afterwards recovered.

In a case reported by Lambotte, a sudden movement of the head was made by a young woman while sewing. Stiffness of the neck and pain in the head followed, but not until a year later did paralytic symptoms ensue. The postmortem showed the odontoid to be fractured across its base transversely and repaired by some fibrous tissue. There was a rotary dislocation of the atlas on the right. The transverse and check ligaments were intact.

The case resembles in many ways one which has been described by Dr. F. H. Albee ("Case Teaching in Orthopedic Surgery," Case VII) (see Case IV, end of article) in which the symptoms followed a jerk of the head secondary to a sudden push of the body.

It is evident then that while violence is the common cause of dislocation and fracture of the upper two cervical vertebræ we must recognize that severe lesions may occur from surprisingly slight traumatisms,—indeed, if we accept Lambotte's case, from muscular action alone.

The More Common Types of Lesion.—We have outlined above the commonest lesion of all, as pointed out by Walton, namely, a unilateral subluxation or true dislocation unassociated with fracture. The rotary dislocation of the atlas on

the axis as described by Corner belongs in this class and is illustrated by the outline drawing in Fig. 1.

The next most common type is the fracture of the odontoid, usually accompanied by rotary dislocations. Skiagraphs of this lesion when compared with the normal lateral skiagraph (Fig. 2) demonstrate very clearly this lesion (*cf.* Figs. 3, 7, and 10). Four of the cases referred to in this article where this displacement has occurred are still living and have had no symptoms of cord compression. This fact is certainly interesting and to the writers has been surprising.

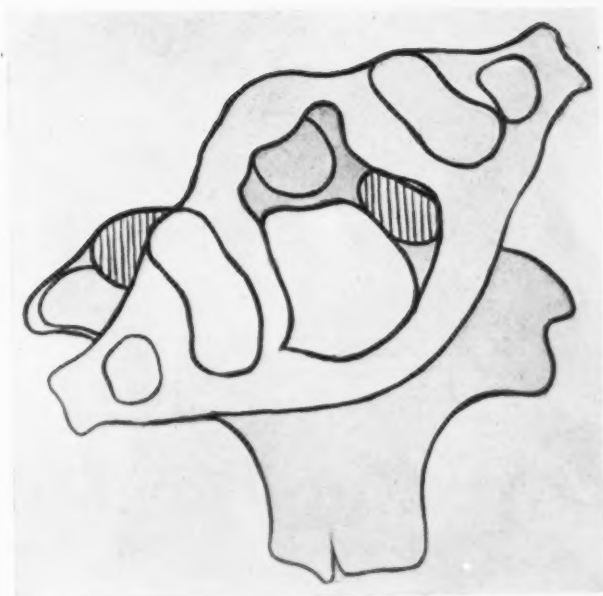
The third and far less common forms of lesion are those in which the arches or lateral masses of atlas or axis have been fractured with or without accompanying dislocations and fractures of the odontoid. Two of the cases which have been observed by the writers illustrate this type (Case II; see page 202. Case VII; see page 205), as does also Van Assen's case (Case III; see page 202).

Immediate Symptoms.—The immediate symptoms which follow these injuries vary from almost instant death to an almost entire absence of all symptoms except neck rigidity and asymmetrical head position. The striking phenomenon is the frequency with which only comparatively slight symptoms result. Severe occipital neuralgias and neck rigidity with increase of pain on any attempted active or passive movement of the head are nearly always present and should lead one to suspect bony lesion.

Subsequent Symptoms.—The rigidity and as a rule the occipital neuralgia persist. Sudden movements or attempts at reduction are often followed by immediately fatal consequences, but the most important end result as shown by many cases reported by Corner has been the gradual onset of a myelitis apparently caused by the irritation of the long-continued abnormal position, or in case of fractures by callus formation (*cf.* Case VI).

Diagnosis.—We need hardly emphasize the importance of the X-ray in making the diagnosis. Lateral X-rays of the neck represent no special technical difficulties, and show well

FIG. 1.



Diagrammatic representation of rotary dislocation of the atlas—and occiput—on the axis. (Corner.)

FIG. 2.



Lateral skiagraph of normal cervical spine.

FIG. 3.



Lateral skiagraph of Case I. Cf. Fig. 2 and note different relations of atlas and axis.

any anteroposterior abnormality and often suggest a lateral asymmetry in a dislocation (*cf.* Fig. 8) (Case V, page 204). The ordinary anteroposterior X-ray of the neck is valueless as far as the atlas and axis are concerned, the mental prominence and teeth entirely obscuring any clear view. If the patient can open his mouth, however, most important information may be had by a skiagraph taken through this wide open aperture (*cf.* Fig. 9) (Case V, see page 204). Odontoid fractures may be seen and any lateral displacement demonstrated.

When good X-rays are not available much may be determined by inspection and palpation. Inspection reveals the probable displacement if one reasons out the lesion necessary to produce the individual asymmetry. By palpation one may discover many things. The line of the spinous processes and their relative anteroposterior position should be first determined. If the spine of the axis is abnormally prominent a fracture of the odontoid is to be suspected. Normally the transverse process of the atlas can be felt half way between the tip of the mastoid process and the angle of the jaw. The location of these processes is, therefore, significant and must be studied. The value of the examination of the pharynx by palpation, preferably under anæsthesia, can hardly be overestimated.

As Corner has originally pointed out, in the rotary dislocations of the atlas two abnormal prominences may be made out, one due to the forwardly displaced transverse process and lateral mass of the atlas on the side of the marked dislocation and the other on the opposite side and a little lower, corresponding to that portion of the axis which is made more evident by the slipping backwards of the atlas.

In spite of the helpfulness of all these signs it is difficult to determine positively the integrity of the odontoid. The importance of this determination is, however, made apparent by several cases in which the penalty for what proved unintelligent manipulation has been the life of the patient.

Treatment.—If one can convince himself that a simple

unilateral rotary dislocation of the atlas or axis has occurred intelligent manipulation offers every hope of cure. Dr. E. W. Ryerson of Chicago and one of the writers have even reduced cases of six months' standing. Walton has called attention to the fact that extension alone, or accompanied by rotation, is an inefficient and somewhat dangerous procedure. If one considers the anatomy of the lesion it is evident that his method is the only rational one.

This consists of first freeing the dislocated articular facet of the upper vertebræ from its position. Whether this upper articular process has simply caught on the apex of the process of the vertebræ below or actually slipped forward into the anterior notch is a difference only of degree. It should be first lifted free and then rotated into place by the manipulation of dorsi lateral flexion followed by rotation. For example, if the left inferior articular process of the axis has slipped forward and we suppose the patient to be facing North, we should first bend the head without traction to the East and South, *i.e.*, to the right and backward, possibly rotating a trifle in the direction of the deformity to better free the process. We should then rotate toward the West and North, *i.e.*, turning the head to the left and bending it forward. This uses the undislocated joint as a powerful fulcrum which is lost if traction be employed as well. It is helpful to remember that the chin will point to the side opposite the main lesion. In a doubtful case where the exact nature of the lesion is not clear and where we may be dealing with a fractured odontoid, we advise support and fixation by means of apparatus such as the Thomas collar, or a plaster helmet, until a definite diagnosis can be made. Corner believes that in cases where the odontoid seems probably to have been broken that the patient should be kept in bed with the head immobilized for at least three weeks; that then an anæsthetic should be given, and with an examining finger in the pharynx an attempt at reduction should be made.

None of the authors consider operative procedures possible. The writers, in conclusion, wish to report an unusual

case, with as far as is known an original operation. In light of the apparent frequency of odontoid fractures which are not immediately fatal and the common subsequent occurrence of myelitis, from the irritation caused by the abnormal mobility it seems possible that this operative procedure may have a wider range of usefulness than we had anticipated.

CASE I.—R. M., age 15, was sent to one of us in July, 1906, by Dr. Maurice H. Richardson for an opinion as to cervical dislocation.

In brief, the history is that five weeks previous he had fallen from a tree, striking his head against a limb on the way to the ground. Immediate pain and stiffness of the neck followed with the appearance of a swelling on the left side high up. The condition had not materially changed since the accident. There had been no paralytic symptoms, though there had been acute paroxysms of pain during which the boy asked to be killed. The pain radiated over the head and down the shoulder and arm.

Examination showed a thin, sick-looking boy, with a tender prominence on the left side of the neck corresponding to a forwardly displaced transverse process of the atlas. This prominence could be felt on the posterior wall of the pharynx. Several X-rays taken at this time and soon after revealed no lesion which could be accurately interpreted.

All motions of the head were restricted and painful. The chin pointed to the right. The left tonsil was enlarged. The temperature was 100° F. Further general examination was negative.

A rotary dislocation of the atlas or possibly the axis was supposed. The boy was sent to the Massachusetts General Hospital, and under an anæsthetic the head was gently manipulated by Dr. Richardson, with an apparent return to normal conditions and almost complete flexibility. This condition remained for a few days. The boy was taken home against advice, but old conditions returned very soon. Six months after the accident the boy was again seen, and as conditions were almost intolerable on account of the severe occipital neuralgia, he was again sent to the hospital and a second manipulation was performed by one of the writers. The same flexibility and apparent reduction were present after this manipulation. More X-rays failed to suggest the real lesion, and in a complete plaster helmet the symptoms were relieved for

one month. The helmet was then removed and a high Thomas collar applied. In a week the symptoms had recurred with added severity and at this examination the spines of the axis and third cervical vertebræ were evidently much more prominent than before. A fracture of the odontoid was for the first time suspected and confirmed by X-rays taken laterally (Fig. 3) and through the mouth.

The symptoms were evidently caused by the slipping forward of the atlas. The odontoid evidently showed no tendency to unite. The boy reentered the hospital on Dr. Mixter's service and was put to bed with head extension. A leather cuirass in two pieces (Fig. 4) was made from an accurate cast taken by laying the patient in a bed of soft plaster and then making the anterior half by pouring over the chest and neck thin plaster cream.

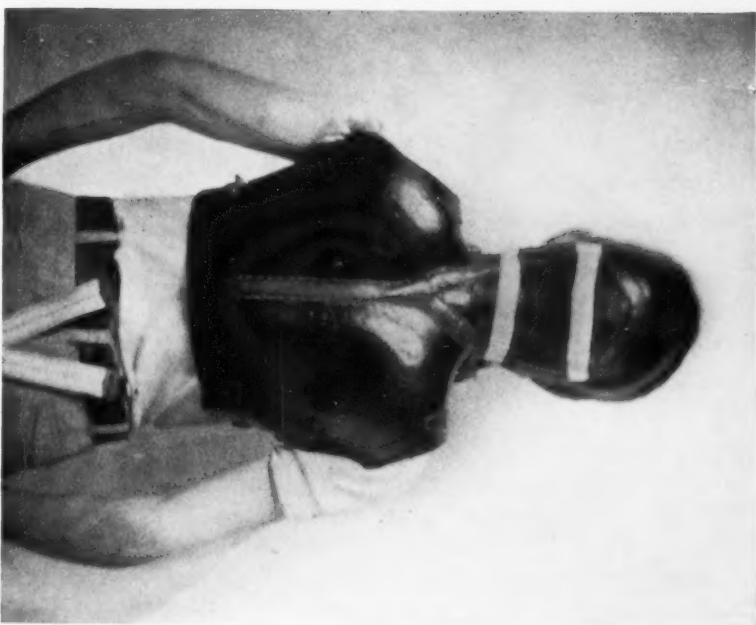
When this accurately fitting apparatus was ready the following operation was performed. The boy was placed in the ventral position, the head being supported manually over the end of the table. A linear four-inch incision was made in the median line of the neck and carried down until the hooked spine of the axis was defined. Next the posterior arch of the atlas forwardly displaced was sought and exposed. With an aneurism needle a stout braided silk soaked in compound tincture of benzoin was passed about this posterior arch between it and the spinal cord. While forward pressure on the anterior arch was exerted through the pharynx, traction was made on the posterior arch. There was firm resistance to replacement and only a slight amount of reposition was accomplished. This was maintained, however, and the atlas firmly anchored by tying the silk band about the hooked spinous process of the axis. The wound was closed with deep silkworm gut sutures, and the leather cuirass applied and strapped tight (Fig. 4, *a* and *b*). The wound was dressed through a posterior window. There was first intention and the boy made an uneventful convalescence, with no paralytic symptoms and an absence of pain. The apparatus was worn for two months, gradually omitted, and up to the present time he has remained well, without symptoms other than slight stiffness of the neck, and has led an active life.

It is now somewhat over two years since the operation and his present appearance is seen in Fig. 5.

FIG. 4a.



FIG. 4b.



Case I. in apparatus applied immediately after operation.

FIG. 5.



Case I.—Present appearance.

FIG. 6a.

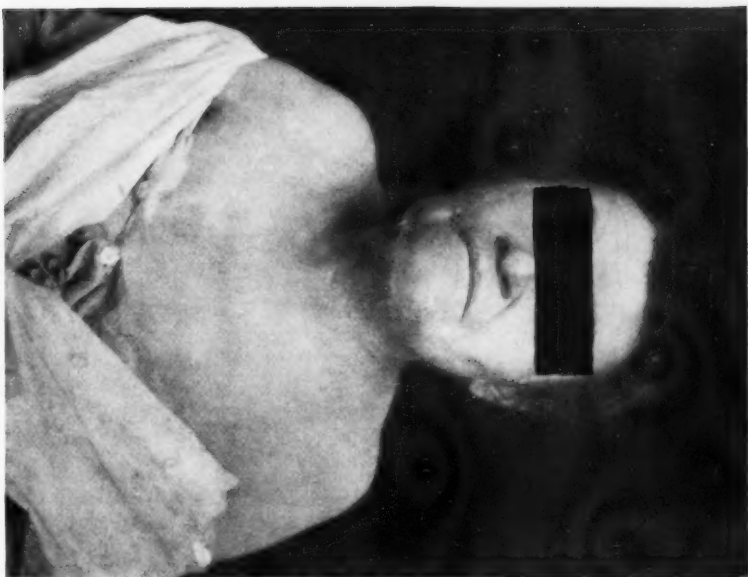


FIG. 6b.



Case II.—Rotary dislocation of atlas on axis. Probable fracture of the anterior arch of the atlas.

FIG. 7.



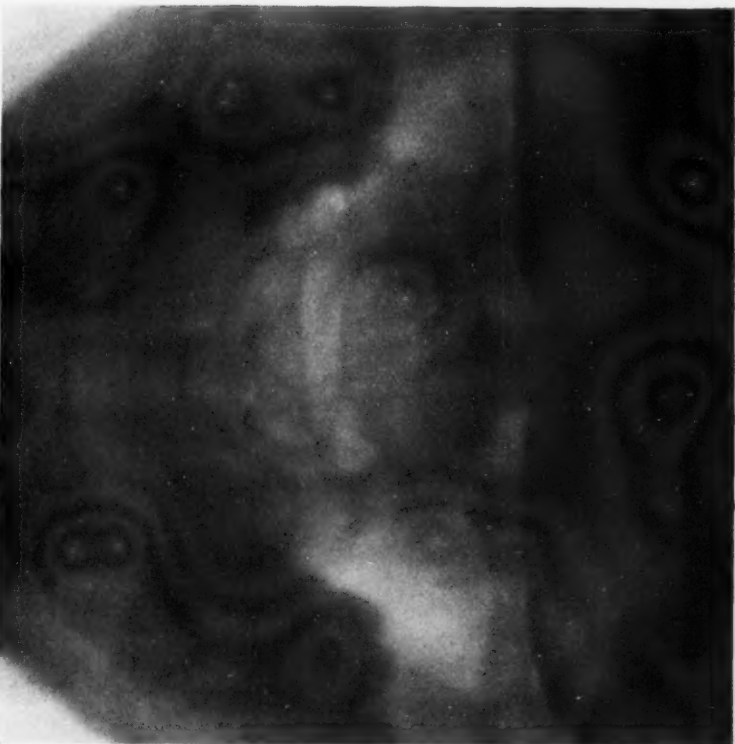
Probable disease of the atlo-axoid joint, with marked forward displacement of the atlas.
No symptoms of cord compression.

Fig. 8.



Lateral skiagraph of Case V. Note the apparent slight forward displacement of the atlas, due to the rotary dislocation. (Skiagraph by Dr. G. S. Johnston, of Pittsburg.)

Fig. 9.



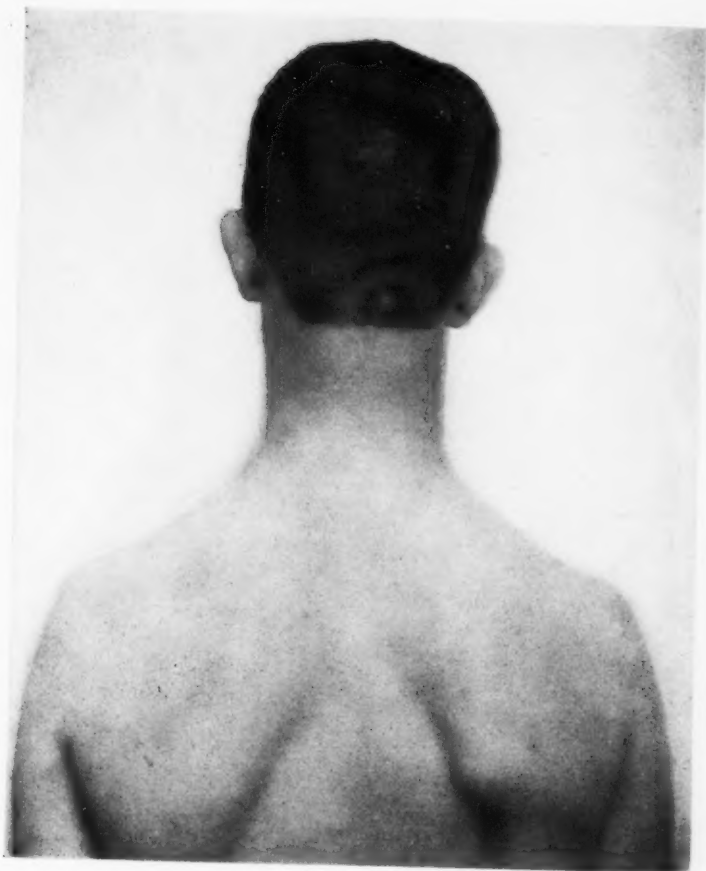
Anteroposterior skiagraph of Case V. Note the clear view of the unbroken odontoid process and the asymmetry of the two alto-axoid joints (rotary dislocation of the atlas). (Skiagraph by Dr. G. S. Johnston, of Pittsburg.)

FIG. 10.



Lateral outlined skiagraph of Case VII, showing marked forward displacement of the atlas.

FIG. 11.



Back view of Case VII. Head held slightly inclined to right.

FIG. 12.



Lateral skiagraph of upper cervical spine of Case VII. Arrow points to fracture of posterior arch of atlas, shown well in the negative but indistinct in the reproduction, appearing like an exostosis.

CASE II.—C. F., age 58; female (Fig. 6, *a* and *b*). Ten weeks before being seen, while groping about during the night to find the bathroom, she became confused and fell down a flight of thirteen stairs, striking head and neck and shoulders. She felt a distinct "crack" in the neck, referred to just below occiput. Not unconscious, she was picked up, but could not open mouth well; immediate pain referred to the right side, and stiffness of the neck; no other noticeable disturbance of motion or sensation. She remained two days in bed and was able during this time to walk to the bathroom. She was unable to lift right upper lid after the accident; no swelling or ecchymosis of eye. In three days she was able to travel several miles in electric cars and climb three flights of stairs. Pain in the head, neck, and shoulders was so severe that she was unable to sleep, and was removed to a hospital. Under ice pack, electricity, and massage, neck pain and severe headaches continued. Shoulder and arm pain disappeared. She left hospital three weeks before being seen, because unrelieved.

Pain was referred to the occipital region and streamed up over the head. On any attempted motion of the head the pain shot through the right shoulder and down the arm. Coughing or sneezing caused excruciating pain.

Physical Examination.—A well-developed woman, standing with a slight deviation of the head to the right and a slight compensatory curve in the cervicodorsal region. All active and passive motions of the head were restricted and painful. A few degrees of rotation remain. The line of the spinous processes can be palpated until the axis is reached, which seems farther forward than normal. On the right side of the neck in the region of the atlo-axoid articulation there is somewhat more resistance than on the left. Pressure over this point and the corresponding region on the left causes pain. The spinal motions below the cervical are apparently normal; no paralysis; no disturbances of sensation; reflexes normal. Inspection of the mouth showed enlarged tonsils, but no inflammatory signs. Palpation of the posterior pharyngeal wall through the mouth showed a greater prominence on the right side.

From the lateral skiagraph no definite lesion could accurately be diagnosed. The anteroposterior skiagraph taken through the

open mouth showed an asymmetry of the two atlo-axoid joints (rotary dislocation on the right) and an apparent fracture of the anterior arch of the atlas.

Treatment.—A Thomas collar was applied, with almost instant temporary relief. High frequency currents were given to relieve the pain, together with gentle massage, etc.

Diagnosis.—Fracture of the atlas; rotary dislocation of the atlas on the axis on the right.

Result.—One year after the accident patient has resumed her occupation as a seamstress, wearing collar much of the time, since it relieves symptoms.

CASE III. (Case of J. VAN ASSEN).—Male, 55 years of age. Since 12, occasional attacks of convulsions and loss of consciousness. Method of injury: One month before being seen slipped from a ladder, struck an open door, and fell about twelve feet on to an asphalt floor; unconscious for only a few minutes.

Immediate Symptoms.—A scalp wound demanded stitches. He remained fourteen days in bed. When the bandages were removed and he attempted to sit up he had immediate pain and stiffness in his neck. This had not been noticed in bed. In spite of massage the pain and stiffness increased. There were drawing pains also in the sides of his neck and on the sides of his occiput. There was no interference with walking or weight-bearing and no difficulty in swallowing. The head was slightly inclined to the right and fixed in slight forward bending; no visual disturbance. Mouth can be opened and tongue motions normal. In the cervicodorsal region of spine is a left convex scoliosis. At the occipito-atloid joint there is a localized deviation. The line of the spinous process is not broken. The mid-line of the face does not correspond to the mid-line of the body, but seems pushed to the right. Pain referred to the vertebral prominence and all through the neck is elicited on all active and passive attempts to lift the head from its slightly forward, bent position. Active turning of the head was impossible and passive attempts were painful. There was a little lateral motion, but accompanied by pain. There was no paralysis. The reflexes were normal and the general examination of heart, lungs, and nasopharynx was negative. There is no record of pharyngeal palpation. The lateral skiagraph showed a fracture of the posterior arch of the atlas. The anteroposterior skiagraph taken through the mouth

showed the mass of the atlas higher on the right than on the left and an apparent fracture of the odontoid process.

Treatment.—Protection of the neck by means of a supportive collar apparatus.

Result.—Final relief of symptoms as long as support was worn (?).

Diagnosis.—Fracture of the posterior arch of the atlas. Probable fracture of the odontoid process. Probable rotary dislocation of the atlas on the axis on the right.

CASE IV. (Case of Dr. F. H. ALBEE, New York).—Miss S., 18 years of age. Two brothers died of tuberculosis. Six weeks before being seen patient caught a severe cold and had a stiff and painful neck. Continued at work for three weeks. On returning from work a man rushing for a car bumped into her, giving her neck a severe twist. The blow did not knock patient down, but she was immediately seized with severe pain in neck and shoulders, and her head had to be supported on her hands all the way home. She was in bed three weeks, then transferred to the Hospital for the Ruptured and Crippled, in the service of Dr. W. R. Townsend, where the following notes were made.

Patient is obliged to hold the head with her hands when sitting or standing. While lying down she usually steadies head with hand. Cervical spine held carefully and rigidly. The head is inclined forward. The cervical spine has lost its normal contour. The forward curve is much exaggerated at its upper part. Neck is tender.

A skiagraph taken soon after entrance shows an apparent separation of the atlas from the axis, the latter bone presenting no sign of an odontoid process. The atlas is more anterior than normal and there is in the skiagraph a clear space of nearly a centimetre between the bones.

Treatment.—Plaster "Minerva" jacket was applied. Later a Taylor spinal brace and chin support was fitted and in this the patient left the hospital.

Result.—Eleven months after accident still wearing apparatus and free from pain. She cannot hold the head up without some support. The spine is less sensitive to passive movements. A prominence can be felt on the posterior pharyngeal wall. Skiagraph at this time shows no open space between atlas and axis

but a still existing marked forward displacement of atlas. No shadow of the odontoid process is seen.

Diagnosis.—Forward displacement of the atlas. Question of tubercular disease.

Case illustrates that the atlas can be displaced far forward without symptoms of cord pressure.

CASE V. (Case of Dr. DAVID SILVER, Pittsburg, Pa.).—S. F., age 9 years. Thirteen months before being seen one of the boy's playmates "bumped" S. F.'s head against a stone wall. Immediate soreness in the neck with some swelling on the right side ensued. Head had to be lifted from the pillow with his hands and patient would scream if not moved carefully. Pain extended up over right occiput and down the right shoulder. Improvement gradual.

Physical Examination.—Chin held slightly to the right with head tilted to the left. Movements of the cervical spine good except right lateral bending, which is moderately limited. On the right side in a spot corresponding to the position of the transverse process of the atlas a distinct bony prominence can be felt. Lateral radiograms essentially negative, except that the atlas casts a shadow more anterior than normal. Anteroposterior radiogram taken through the mouth showed a rotary dislocation of the atlas on the axis. Odontoid apparently intact. Cutaneous test for tuberculosis negative.

Treatment.—At first extension in recumbency. Later Thomas collar. Now wearing no apparatus (two years, eight months since accident).

Diagnosis.—Rotary dislocation of the atlas on the axis.

Result.—Improved position of head and freer movement. Still present (June, 1909) a slight tendency to hold the head to the left.

CASE VI.—D. F., Massachusetts General Hospital, W. Surg. Records, vol. 447, p. 101. September 8, 1903 (entrance). Five and a half months before entrance was in a railroad accident, sustaining severe scalds about shoulders and arms, and scalp wounds. The sight of right eye was destroyed. After accident head was found to be thrust slightly forward and immovable; no paralysis. Two months after accident, while head was being bandaged, something slipped, and could move head more freely. Ever since accident there has been difficulty in swallowing owing to a "ledge" in the back of his throat.

Physical Examination.—Head thrust forward and attitude like that of a stork; slight sideways and rotary motion. X-ray shows a dislocation of the atlas on the axis forward and downward, with possible fracture of the articular processes (see Fig. 10).

September 9: Manipulation under ether with head traction and rotation. Adhesions gave way, click felt, and head in more normal position; plaster helmet for one month. Head could at end of this time better be supported without apparatus. "Ledge" had disappeared from posterior pharynx, but second cervical spinous process was displaced to the left. Sent out with new plaster helmet, October 8, 1903.

Re-entry, January 25, 1904. Well up to one month ago when neck began to grow stiff and sore, and three weeks ago prickly sensation began in right hand. Two weeks ago right foot affected. At entrance loss of power in both hands and both feet and spastic condition of upper and lower limbs. Examination of pharynx shows no recurrence of "ledge."

Operation, January 29, Dr. Mixter.—Laminectomy of third and fourth cervical vertebræ. Arches of atlas, and axis found ankylosed and depressed, pressing into cord apparently from callus formation. These pressing protuberances removed. Fixed on Bradford frame. Improvement in pressure symptoms in both arms and legs continued for about four weeks.

On the night of February 26 sneezed; felt something give way in his neck and became completely paralyzed. Head traction employed without effect. Died March 1. Temperature 107.5°. No postmortem allowed.

Diagnosis.—Complete dislocation of atlas on axis. Fracture of arches of atlas and axis.

CASE VII.—J. J. C., single, laborer. The patient fell from a staging about sixty feet, striking on the right shoulder and side of the head and the neck; taken to a hospital; unconscious for sixteen hours; in bed three weeks. Head was stiff; pain on the right side of the head running over occiput, and the neck very much ecchymosed and swollen. There was difficulty in raising both arms, especially the right; no other signs of paralysis or paresis. No X-ray was taken and he returned to his home in three weeks. Pain continued; unable to be up more than for a few hours. One month ago reported at the Massachusetts

General Hospital. No definite lesion was at that time made out.

Seen by the writer seven weeks after accident. Stands with head to the right, chin to the left, with slight but distinct asymmetry (cf. Fig. 11); reflexes normal; pupils equal and react to light and distance; motions of the spine and other joints normal. The line of the spinous processes is apparently straight, not well defined in the upper part of the neck, where there is some spasm of the muscles. Voluntary forward and back motions of the head most markedly restricted. The rotation to the right is the most marked limitation of all motions. Lateral motions are quite free. All motions are painful when carried to the limits of muscular resistance. On palpation a mass can be felt between the mastoid process and the angle of the jaw on the left, more prominent than on the right. Inspection of the thorax negative, but palpation shows a greater bony prominence on the right side. Anteroposterior X-ray taken through the mouth shows no fracture of the odontoid but simply asymmetry of the two lateral masses of the atlas. Lateral X-ray shows an apparent fracture of the posterior arch of the atlas (Fig. 12).

Diagnosis.—Fracture of the posterior arch of atlas on the right. Rotary dislocation of the atlas on axis.

Treatment.—Hydrotherapy. High frequency. Thomas collar.

Result.—Gradual disappearance of pain and increase in mobility of head.

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ATLO-AXOID FRACTURE-DISLOCATION.

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As a further contribution to the subject of fracture-dislocations of the first two cervical vertebræ, which has been so ably treated in the preceding paper by Drs. Mixter and Osgood, I desire to place on record the following case which has now been under my personal observation for a period of nearly ten years and therefore fairly represents the possibilities of ultimate repair and restoration of function which may take place in such cases.

The patient, a man 33 years of age, of average good health, and a house painter by occupation, on August 6, 1900, was precipitated headlong from a ladder a distance of 15 feet, striking on his forehead. Immediately thereafter he was able to stand and walk, but was obliged to support his head by his hands. He suffered much pain which was referred to the back of his head and upper part of his neck. He was at once taken to the nearest hospital where he was retained for ten days. During this time, according to his statement, his head was notably bent over towards his left shoulder and was fixed in so great flexion that he could not open his mouth more than half an inch. He had no symptoms other than suboccipital pain and the deformity and stiffening of his neck. Still in this condition, at the end of ten days he left the hospital and returned to his home, where for two months his condition remained unchanged. During this time he was able to walk about his house but did not venture on the street. He then began to be conscious of a growing lack of power in his lower limbs, most marked upon the right side.

During the evening of October 27, 1900, while walking from his chair to the bed, suddenly his knees gave way under him and he would have fallen but for the support of one of the members of his family. He was put to bed and it was discovered that he had no control over his right arm and leg, except that he

could move feebly the fingers of his right hand and the toes of the right foot. He had some control over his left arm, leg and foot, but only to a limited degree. He was unable to urinate, so that regular catheterization had to be instituted. Three days thereafter his right arm and hand had become totally paralyzed. His neck and head, which up to this time had been the seat of much pain, now ceased to trouble him except after some sudden movement.

In this condition, November 7, 1900, three months after the primary injury, he was received into the Methodist Episcopal Hospital of Brooklyn and placed in my service. When received his bladder was still paralyzed, requiring the regular use of the catheter. An acute cystitis had developed. His bowels were constipated but responded to cathartics and enemata. The upper and the lower extremity of the right side were both paralyzed. To faradic stimuli there was no response in the muscles of the right forearm, except in the extensors of the thumb. Flexor profundus digitorum, very weak reaction. Lumbricales and interossei, very weak. Extensors carpi ulnaris and radialis, both very weak. On the arm proper, the biceps and the triceps gave feeble reaction. Deltoid, no reaction. Pectoralis major, feeble reaction. Shoulder muscles, very weak. In the thigh, quadriceps extensor, reaction slight. Posterior flexors of knee, reaction active. Muscles of leg, reaction slight. Diminution of temperature sense over whole right upper extremity. Pain sense absent in both upper and lower extremity. In the left arm and leg the muscular reactions were normal. The head was held in a position of rotation to the left with a curvature of the neck toward the right. No power of flexion or rotation. The outlines of the upper cervical vertebræ were obscured by an abundant dense exudate which was most voluminous on the right side. The spinous process of the axis was slightly twisted to the right of the median line. A finger passed to the back of the pharynx could appreciate a marked concavity in the anterior surface of the spinal column below the second vertebra.

At the end of six weeks' residence in the hospital his condition remained practically unchanged. In view of the possibility that the cord symptoms might in part be due to pressure from a depressed fragment of a lamina, it was decided to expose the axis and atlas. This was done December 19, 1900, through a

vertical incision extending from the occipital protuberance to the level of the seventh cervical spine below. No fracture of any lamina was uncovered, but a forward dislocation of the atlas upon the axis was demonstrated to be present. Careful efforts to correct the displacement were futile. The wound was closed and the head, neck and upper thorax supported in a plaster cuirass. A smooth operative recovery followed. A slight improvement in his paralytic conditions gradually developed during the subsequent weeks. He became able to empty his bladder spontaneously and two months after the operation began to sit up. On June 8, 1901, seven months after the reception at the hospital and ten months after his injury, he asked to be returned to his home. He was still hemiplegic but had normal power over his bladder. During the entire time of his stay in hospital his appetite had always been good and his digestive power fair.

Later History.—A gradual return of power in the paralyzed leg manifested itself after his return home and continued until the normal condition was regained. Improvement also in the right upper extremity took place, but less fully than in the lower extremity.

An examination made of his condition September 2, 1909, nine years after his accident, gives the following: The condition of the head and neck is unchanged as regards deformity and immobility. A dense mass as of organized callus surrounds and obscures the outlines of the atlas and fills the space between the axis and base of the skull, being most voluminous on the right side. The accompanying skiagraphs (Figs. 1, 2, 3) which were taken in August, 1909, by Dr. Charles Eastmond, reveal the outlines of the atlas and axis greatly altered and fused together in an irregular mass. There seems to have been a fracture through the lateral mass of the atlas on the right side with a crush of the body of the axis; the head and atlas with the upper portion of the body of the axis, including the odontoid process, has slipped forward and rotated to the left. He is able to walk normally fairly long distances without much fatigue. No difference of strength between the two lower limbs. He is able to elevate both shoulders, but there is a decided droop of the right shoulder. All the muscles of the right arm and forearm are less developed and weaker than those of the left arm, but all have

FIG. 1.



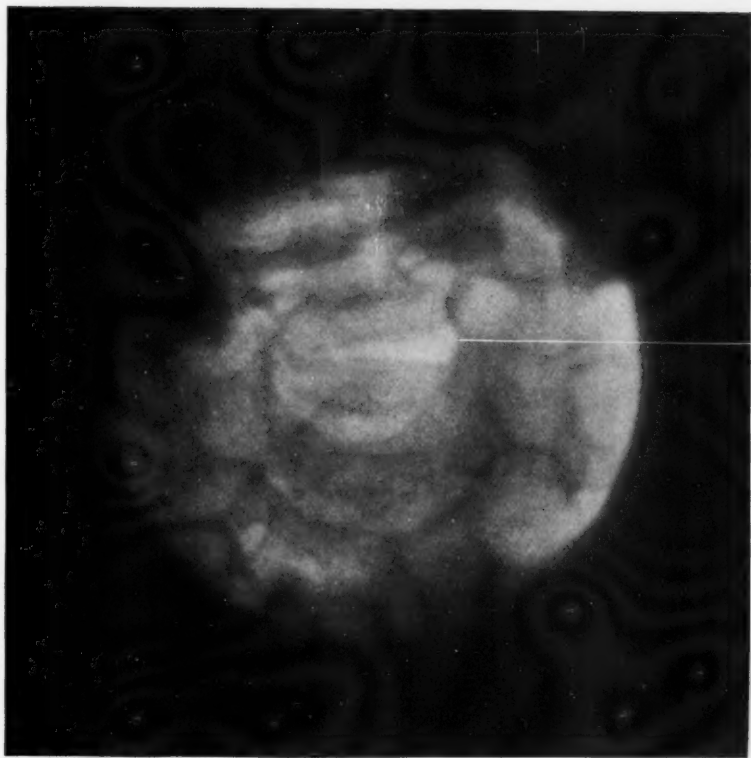
View taken with right side nearest the plate. The atlas is obscured by the tilted and rotated occiput which has brought the mastoid process into the plane of the atlas. The outlines of the axis are rendered hazy by ossified callus.

FIG. 2.



View taken with the left side nearest the plate. The outlines of the atlas are well revealed and the forward displacement of this bone upon the axis is clearly shown; the lateral masses of the atlas and the body of the axis are fused together in an irregular mass, which projects notably in front of the plane of the lower part of the body of the axis, and produces a marked angle whose apex is at the anterior margin of the cartilage between the axis and the third cervical vertebra; irregular lines are perceptible in the fused atlo-axoid mass which suggest former fragmentation of these bones; a mass of ensheathing ossified callus surrounds the lamina of the axis.

FIG. 3.



Anteroposterior view through open mouth. The structure most clearly identifiable is the intervertebral cartilage between the second and third vertebrae, marked *A*.

FIG. 4.



Healed atlo-axoid fracture-dislocation. Note in *A* the rotation of the chin to the left and the bend of the head to the right (reversed in the photograph). Note in *B* the pose in which the head is rigidly held. Note in *C* the scar of operation in the midline of the neck. The dark spot to the right of the upper part of this scar is a dot of iodine placed to mark the location of the spine of the axis.

regained some power; extension and flexion at the elbow is normal in range. Pronation and supination of forearm are normal in range. The right hand presents to a moderate degree the condition of *main en griffe*. The flexor carpi ulnaris and radialis are contracted, as is also the flexor profundus digitorum. Extensor carpi radialis and ulnaris are too weak to overcome the flexors, so that the hand is held in position of flexion with extension of the first row of phalanges and flexion of the two distal rows. The lumbricales and interossei are normal. The muscles of the thumb are normal. He can approximate the thumb and first digit. There is no power to grasp by the hand as a whole. The left lower extremity is normal. The bladder functions are normal. His mentality is unaffected. Appetite and digestion good. Bowels move regularly. His general health is good.

The accompanying photographs (Fig. 4), were taken January 1, 1910, to show the present condition of this man. There is no motion, either of flexion or rotation of the head upon the neck; the bony ankylosis between axis and atlas, and the atlas and occipital bone is apparently complete. The rotation of the head to the left, and the inclination of the head to the right is well shown.

MALIGNANT DEGENERATION OF BENIGN DISEASES OF THE BREAST.*

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THE advances made in surgery of the mammary gland have been due, to a considerable extent, to the aid furnished by pathologic studies. The subject of benign tumors of the breast was obscured for many years by a lack of uniformity in nomenclature, a confusion which has been dispelled by a suitable classification of these affections. Recent pathologic studies of benign breast diseases have elicited a very important fact, namely, that a fairly high percentage of the benign tumors and diseases of the breast undergoes a secondary malignant degeneration. A study of certain types of benign tumors, with the object of determining the approximate percentage of malignancy and the signs by which it can be recognized, should be of value from the prognostic and surgical standpoint.

In reporting the following cases, Warren's¹ classification has been followed. The cases examined are used as types of the various benign affections, the discussion following is based upon the most important recent communications of the subjects in question.

Fibro-epithelial tumors.—Warren divides these tumors into two divisions—the fibrous type and epithelial type. In the first group are included the periductal fibroma, the periductal myxoma and the periductal sarcoma. The second division comprises a class of tumors which are rather uncommon—the cystadenomata—which are subdivided into the fibrocystadenoma and the papillary cystadenoma.

* Read before the Philadelphia Academy of Surgery, Nov. 1, 1909.

The periductal fibroma (adenofibroma) occupies an important place from the standpoint of frequency, occurring in 7 per cent., whereas the entire group of fibro-epithelial tumors comprises 11 per cent. of the entire number of breast diseases. Warren has advocated the terms "periductal fibroma" because the chief constituent of the fibro-epithelial tumors of the fibrous type is the peculiar periductal tissue of the breast. This tissue develops at a time when the majority of the fibrous tumors occur, between puberty and lactation; it is part of the structure of the breast, and its close relationship with the epithelial elements makes it impossible for one type of tissue to undergo tumor formation without involvement of the other. The name "adeno" is reserved by Warren for the tumors in which the epithelial elements play a more important part.

The clinical features of periductal fibromata are too well known to warrant any extensive discussion, although certain deviations from the usual type encountered are of interest. The growth occasionally progresses steadily until it reaches enormous size, weighing, in some of the cases, as much as eight or ten pounds. In such instances, as reported by Finsterer,² Anger³ and others, the patients are advanced in years (forty to fifty) and the growth is of many years duration. Cases have been reported in which benign tumors have been present for a period of ten to twenty years before malignancy developed. Ulceration of the skin, cystic degeneration of the tumor, a constant increase in pain and enlargement of the axillary lymphatic nodes may occur. Such symptoms are highly suggestive of malignancy, but microscopic examination of the tumor may not show evidence of carcinomatous formation. Fortunately this type of rapidly growing but benign tumor is becoming rare, because few are permitted to reach such size without operative interference. Therefore, the more common type encountered is the small, well circumscribed, single or multiple tumor. Sufficient histologic evidence is present to prove that this form becomes malignant, although clinical facts pointing to a recognition

of this complication are not numerous, and not infrequently the microscope shows quite accidentally that the tumor removed has undergone carcinomatous degeneration. Anger³ reports a case in which islands of cancer were present in a fibroadenoma, which in spite of its large size (7 k.) and long duration did not appear malignant. The skin was normal, the tumor freely movable and the axillary lymphatics were uninvolved.

Microscopic studies of the secondary epithelial changes in benign tumors have been more numerous in connection with abnormal involution and with the cystadenomata. While fewer cases are on record of malignancy occurring in periductal fibroma, yet the underlying changes are practically the same as in other conditions. Kuru⁴ believes that the carcinoma, in such instances, arises by means of active epithelial growth which is associated with a simultaneous adenomatous proliferation, and he agrees with Müller,⁵ that the process begins as a multicentric formation. Some pathologists deny that cancer occurs secondarily to benign tumors, and claim that it takes its origin from misplaced cells,—that the two tumors grow independently and finally become associated by the enlargement and infiltration of the carcinoma.

Sudden enlargement of a previously existing latent tumor should always be regarded as a suspicious symptom. Axillary involvement is not always conclusive, as it may be of inflammatory origin and was found by Finsterer² seven times in sixty-four benign conditions of the breast. Rapid growth of a benign tumor may be associated with ulceration, loss of weight and weakness, so that the symptoms of an early cachexia are simulated.

A tumor, previously movable on the underlying structures, which becomes adherent presents one of the most reliable signs of malignancy; but this symptom does not occur until the disease has become well advanced. Dimpling or adherence of the overlying skin should always be regarded as highly suggestive of carcinoma. Pain seems to be a variable symptom in benign lesions of the breast. Its occurrence has been

noted by many writers, but when associated with rapid enlargement of the tumor (and particularly when the severity of the pain constantly increases) a malignant degeneration should be suspected.

Statements as to the cause of malignancy in benign affections are rather scanty although traumatism and pressure are supposed to play an important rôle. Elsasser⁶ observed a case in which exposure was said to have caused rapid growth and malignancy of an adenofibroma. An hereditary predisposition was present in both of the cases which this author has recorded. An associated mastitis or lactation may be injurious to benign tumors; the effect of pregnancy is discussed under the second case reported. Several of the cases recorded have occurred in women who have never borne children, nor have suffered from previous diseases of the breast.

We find, therefore, that certain tumors which present symptoms suggestive of malignancy do not show the histologic changes of the same, and, on the other hand, carcinoma occasionally arises in a præexisting tumor without causing symptoms indicative of such a transformation. We can conclude from these statements that operative interference in all tumors of the fibro-epithelial type is indicated to prevent this complication.

In the Laboratory of Surgical Pathology, University of Pennsylvania, two instances of carcinomatous changes in periductal fibroma have been observed in 17 cases studied pathologically. In both there were one or two symptoms which were only suggestive of cancer. In the first case the skin was not freely movable over the tumor, and in the second an enlarged hard axillary lymph-node was present. Beyond these doubtful symptoms, there was no evidence of carcinoma which was not seriously considered in either case.

The clinical histories and pathologic descriptions of the two cases follow:

CASE I.—M. J., aged 45, unmarried, was admitted to Dr. Frazier's service for a growth in the left breast of seven months

duration. The tumor was not painful, had grown slowly until it reached the size of an egg, and seemed to the patient, to be slightly more fixed than formerly. Patient cannot recall any injury to the breast, and she has never had any soreness of the nipple. The tumor was situated to the right and passed beneath the nipple which is normal. The skin was movable over the growth but not freely, and the tumor was entirely movable over the chest wall; it was not painful on palpation, but hard. The axillary lymphatics were uninvolved.

Operation: The tumor was found to be well encapsulated, presenting the characteristics of a benign growth; it was not deemed necessary to perform a more radical operation than removal of the tumor with the surrounding skin and all glandular tissue—a precaution which was made on account of the patient's age. The patient recovered from the operation and when seen 22 months later showed no signs of a recurrence.

Specimen on examination consists of the breast, and surrounding fat. The skin is freely movable and unchanged in appearance, the nipple slightly retracted. A small nodular mass is palpable through the skin but has no relationship with the nipple. On the posterior surface a well circumscribed, round encapsulated tumor the size of an egg is seen embedded in the breast tissue. The mass is not adherent to the surrounding tissue and presents on section a reddish white appearance. The red areas are soft, contain a few small cysts, and are directly continuous with the white indurated portion which cuts with more difficulty than the other part of the tumor. The induration is almost the size of a pea, and represents but a small proportion of the tumor from which it so differs in appearance that the impression is given of tissues of different type. The remaining portion of the breast on careful examination, particularly the nipple region, is free from gross change.

Microscopically, the sections taken from the tumor show a proliferation of the periacinous fibrous connective tissue which is quite cellular and completely surrounds the ducts and acini. The latter are regular in appearance, and are lined for the most part by a single layer of cuboidal epithelium. Many of the ducts are dilated, forming small cysts, the lining cells are low and a few papillary projections are seen within the lumen. The fibrous overgrowth has compressed many of the cystic dilatations so

that they appear as slits, resembling the form of tumor described as pericanalicular fibro-adenoma.

The second portion of the growth retains the appearance of a periductal fibroma, but in addition an epithelial hyperplasia is present. This occurs in many of the acini and ducts which are filled with cells which have no tendency to infiltrate the fibrous stroma. The cells, for the most part, are regular in appearance; in some acini many layers are present and here some irregularity in the shape of the epithelium is seen. In many areas the circumscribed appearance is lost, and the epithelium infiltrates the connective tissue spaces as thin lines or processes. In other places the cells are heaped up and form small collections in the tissues; a glandular reproduction, however, is not present. The tissue in which the malignant degeneration has arisen is to a slight extent invaded by leucocytes, shows considerable dilatation of the blood-vessels and some free blood in the tissues.

Examination of the breast tissue surrounding the tumor and in the neighborhood of the nipple shows changes of involution. Pathological diagnosis: Periductal fibroma, carcinomatous degeneration.

CASE II.—The patient, aged 45, had noticed a growth in the upper and outer quadrant of the right breast for six years. It was painless, of slow growth, and did not produce any symptoms. Her last child was born 10 years ago; she has not had any previous breast disease. About four months ago she became pregnant, and shortly afterward noticed that the tumor began to enlarge, but did not become painful. On examination a small, well circumscribed tumor was discovered in the breast and a single enlarged node in the axilla. In view of the rapid enlargement and lymphatic involvement, her family physician advised removal of the tumor, which was done by Dr. A. C. Wood.

Specimen consists of a tumor about the size of a hazel nut, the surface is pale and the cut surface smooth and rather fleshy in appearance. The tissue is arranged in concentric bundles, and has a firm consistency. Attached to the tumor is a mass of fat and muscle tissue in which there is but one small piece of indurated material which shows a firm white focus.

Microscopic sections were taken from the lymph-node removed

from the axilla and the breast tumor. The breast tissue has the typical appearance of a periductal fibroma, the ducts and acini being surrounded by periacinous tissue, and do not show any cystic changes. The epithelium is hyperplastic, as in the previous case and again has the tendency to fill the ducts and acini, and in many areas has broken through its normal limits and has invaded the fibrous stroma in the form of cellular processes somewhat resembling an early form of scirrhus. The lymph-node shows slight hyperplastic changes but no metastatic growth. Pathological diagnosis: Periductal fibroma, beginning carcinoma.

The active state of the breast incident to pregnancy undoubtedly was of great importance in promoting the malignant degeneration in this case. The epithelium of the periductal fibroma, already in a state of instability by reason of proliferative changes aided by the advanced age of the patient, was thus readily transformed into a malignant process. As the tumor was well circumscribed, the lymph-node uninvolved and the carcinoma of an early form, the patient is being carefully observed, a more radical operation not being performed. Without removal of the tumor, and with increasing functional activity of the gland, a form of rapid carcinomatous involvement of the entire breast, such as is frequently seen during pregnancy and lactation, may have developed.

Abnormal Involution.—For the sake of uniformity in following Warren's classification the above term is adopted. The older name, "chronic cystic mastitis," advocated by König, is still used by many writers, and while it suggests to the pathologist the exact condition in the breast, yet by many it has been confounded with acute pyogenic mastitis. König⁷ and others believe the disease to be infectious in nature, and by a few it is described as a tumor formation. Recent studies, however, assign the cause to certain abnormalities occurring in the breast during its involution. These changes consist largely in hyperplasia of the epithelium incident to cyst formation, produced in turn by fibrous overgrowth. The tendency toward uniformity in classification of breast disease is gradually being extended to this type in

which heretofore the greatest difference and laxity in nomenclature has existed. Thus we find that Theile⁸ in his study concludes that fibro-adenoma, cystosarcoma phyllodes and chronic cystic mastitis form a group of diseases which arise from the same elementary histologic changes, and which are distinguished from one another by a more or less pronounced encapsulation, through the predominating growth of the connective tissue in some and the epithelium in other cases. The original process is to be regarded as neither inflammatory nor as a tumor formation, but as a form of fibro-epithelial degeneration which may manifest itself in one of the tumor formations named. Further evidences of regression are seen in malignant degeneration of the connective tissues into sarcoma, or the epithelial elements into carcinoma. The latter variety is much the more common, although a few instances of sarcomatous transformation have been recorded. Early malignant change as such can probably be recognized by the microscope only, the two varieties producing symptoms which can not be differentiated.

Two varieties of abnormal involution may be distinguished, the cystic and proliferative. The latter class is divided into three subdivisions: (1) Proliferation of the acini, (2) papillary outgrowths of epithelium into cysts, and (3) adenomatous proliferation of epithelium. While the difference of these subgroups is mainly histologic, the degree of epithelial proliferation varies so much that they should be briefly discussed. According to Warren's summary, we find that the first type shows an increase in acini which is accompanied in the majority of instances by a proliferation of the epithelium to such an extent that thickened or even solid columns of cells are produced, retaining, however, the formation of the gland ducts, and presenting no infiltration beyond the basement membrane. While the significance of this form is not determined, it may lead to carcinoma.

In papillary proliferation we find a growth of epithelium in the cyst cavities of such a nature that the cells are heaped up and project into the cavity without a connective tissue

pedicle. The picture suggests that more epithelium is produced in the lining of the cyst walls than can be accommodated on the basement membrane, and is thus thrust into the cyst cavity.

In the third group, adenomatous proliferation is met with, and only in cases in which papillary outgrowths are already present. This form represents a more advanced type of epithelial hyperplasia, and is, therefore, most commonly associated with a carcinomatous degeneration. Nine of Warren's cases were seen in connection with involution changes of the papillary and adenomatous types. Bloodgood⁹ has observed more malignant than benign cases of this variety. The five cases of adeno-carcinoma which I have studied showed adenomatous proliferation in each instance. The acinal type of abnormal involution is more likely to degenerate into a scirrhus variety of carcinoma, as occurred in three of Warren's cases, and in one of my series.

Abnormal involution occurs more frequently than any other affection of the breast, with the exception of carcinoma. According to Warren, it constitutes 15 per cent. of all breast diseases, and Bloodgood states that it is seen in 25 per cent. of all benign cases. An analysis which I have made of 180 cases of breast disease shows that it occurred in 18 per cent., and of the 35 cases studied in this laboratory 9 instances of malignancy were encountered (26 per cent.). The following table represents the number of cases of abnormal involution studied by different observers and the number of malignant cases in each series:

	No. of cases	No. carcinoma.
Warren ¹	115	15
Greenough and Hartwell ¹⁰	30	3
Sasse ¹¹	9	2
Ruloff ¹²	11	4
Lichtenbahn ¹³	5	0
Theile ⁸	19	3
Verga ¹⁴	28	5
Schimmelbusch ¹⁵	43	3
Speese	35	9
Total cases	295	44
Carcinomatous, 15 per cent.		

A malignant degeneration in 15 per cent. of the cases represents the general opinion of many observers who have studied this disease. In the cases observed 26 per cent. were found to be malignant, a percentage somewhat higher than other writers. The diagnosis of malignancy depended on the general aspect of the epithelium, the regularity of the acini, penetration of the basement membrane and tendency toward invasion of the stroma. The size of the cells is also to be considered, for irregularities in size and shape is suggestive of carcinoma. The presence of clear, vacuolated cells (*blasse Epithelien*) indicates proliferative changes, as pointed out by Müller and Theile, and when present in abnormal involution, is not diagnostic of carcinoma.

The symptomatology and gross pathologic changes of abnormal involution are so well understood that time will not be taken to describe them. In general, the diagnosis of the condition, especially the diffuse variety, is not difficult. Malignancy is more likely to occur in women past the forty-fifth year of life. In the nine cases reported the youngest patient was 35, the oldest 65, and the average age 47. In many instances the disease had lasted but a few months from the time of observation until operation was performed. In Bloodgood's experience the duration of the disease has been less than four months in cases in which the clinical diagnosis is doubtful. In the adenomatous variety, we find too, that the growth is apt to be more rapid than in the cystic type. In the majority of early cases there are no signs by which a malignant degeneration can be diagnosed. Enlargement of the axillary lymph-nodes, slight inversion of the nipple, induration of the tumor, pain and tenderness, rapid growth and discharge from the nipple are all symptoms seen in non-malignant cases. The diagnosis of early malignancy will have to be made in the majority of instances at the time of operation, when incision into the suspected area will disclose the carcinomatous tissue.

In doubtful cases exploratory incision is indicated; a careful search throughout the entire part involved is necessary,

for the malignant area is apt to be quite small. Malignancy being detected, a radical operation should be performed. In case of doubt, the entire breast should be amputated, and if the axillary lymph-nodes are enlarged they should be removed. The exploratory incision does not reduce in any way the chance of ultimate cure, whereas exploratory incision followed by the radical operation for malignancy at a later period has been invariably fatal according to Bloodgood. In the majority of cases studied, the carcinomatous area has been small, so that if dependence is placed upon frozen sections made at the time of the operation, great care must be observed to select a suspicious area. As one becomes familiar with the gross changes of this disease, less attention will be paid to frozen sections and the diagnosis will be made from the macroscopic appearance. Malignancy is often so early that careful study of specimens hardened to cut in the usual manner is necessary before the diagnosis can be made. For this reason, I have gradually given up the use of the freezing microtome as a diagnostic aid, and place entire dependance on the naked-eye appearance of the affected tissue.

The bilateral character of the disease is one of its interesting features, and one for which occasionally double amputation has to be performed. Several instances have been observed in which patients have been forced to undergo secondary operations on the opposite breast after having had one amputated for abnormal involution. If indurated areas are present in both breasts, especially in women over forty, a bilateral operation should be performed, and both breasts, or the diseased areas removed. Many of the cases of bilateral carcinoma recorded have in all probability originated in abnormal involution which began as a bilateral affection in both breasts. Case XI of the series supports this view, for in each breast definite carcinomatous nodules were present in association with the changes of abnormal involution.

Certain instances of abnormal involution appear to undergo spontaneous cure, the contents being discharged through the nipple, or the cyst rupturing. More frequently a stationary

stage may be encountered, or the epithelial proliferation advance to malignancy. Cases are encountered which probably represent the initial changes of abnormal involution, definite areas of induration are not palpable, but more or less discomfort is experienced. In this type careful observation may be employed, but in no other form of abnormal involution are temporizing methods to be tolerated, because of the danger of cancer.

CASE III.—Mrs. M. S., aged 55, service of Dr. Edward Martin. Mother of several children, no previous breast disease. Two years ago the patient received a severe blow on the left breast which has been painful since the accident. About six weeks ago a small nodule was noticed in the breast. There was slight pain and tenderness, the skin and nipple normal, and on palpation the tumor was hard, not larger than a hazel nut and adherent to the surrounding tissues. The axillary nodes were not palpably enlarged.

Specimen (2497) is a breast with underlying muscles and axillary tissues. On section a hard nodule about $1\frac{1}{2}$ cm. in diameter is found which shows a fine yellow mottling at the centre surrounded by a translucent greyish tissue which sends off fine fibrous processes into the surrounding tissue, and by contracting cause a puckered appearance at this point. Throughout the process there is considerable greyish parenchyma which seems increased and more fibrous than normal, but nevertheless there are no frank characteristics of malignancy except at the one point first noted. The nodes in the axilla are very slightly enlarged, soft, and grossly do not suggest metastasis.

Microscopically the breast tissue near the growth is very fibrous in appearance and contains numerous small cysts. The glandular acini are slightly increased in number and are so compressed by the fibrous tissue that they resemble the cellular processes of a scirrhus. In some areas a moderate hyperplasia of the epithelium has occurred in the acini. While the abnormal involution here seems to be of the cystic type, slight hyperplasia is present. Numerous sections do not reveal a process which can be regarded as predisposing to cancer. That this must have occurred somewhere in the process of abnormal in-

volution is shown in the sections taken from the dense nodule, where the compressed epithelium is seen surrounded by a dense fibrous stroma—the picture being a typical scirrhus.

Diagnosis: Abnormal involution (acinal type). Scirrhus carcinoma.

CASE IV.—Mrs. M. M., aged 44, service of Dr. J. W. White. About one year ago the patient noticed that the left breast was somewhat larger than the right. One month ago she received an injury of this breast, and noted then for the first time that several hard nodules were present. Since then she has had pain and the tumors have increased slightly in size. She has had two children, but did not nurse either one. The nipple and skin are both normal, and the nodules do not seem adherent to the surrounding parts.

The specimen (2237) obtained by the operation consists of two portions of breast tissue measuring about 14 x 6 cm. Two distinct processes are seen in the breast, the first a rather diffuse infiltration of dense, glistening, whitish tissue in which a few cysts about the size of a pea are present. This process is not very marked, and extends through a small portion of the breast. The second process consists of a soft pinkish mass of tissue about the size of a hen's egg which shows softening and degeneration in its centre. Section through the latter demonstrates a dense mass which is adherent to the surrounding breast tissue.

Microscopic examination of the first process shows marked increase in the number of acini, in which the epithelium is slightly proliferated. The stroma is dense and contains but few cells. Cyst formation is inconspicuous and proliferative change, beyond that noted, is not present.

The soft tumor mass reveals evidence of extensive leucocytic reaction which in some places obscures the tumor tissue. The latter is seen as collections of large and slightly irregular epithelial cells occurring in masses and showing mitosis. The inflammatory reaction which extends to the surrounding tissues, was probably caused by the injury received.

Diagnosis: Abnormal involution (Acinal type). Carcinoma.

CASE V.—Mrs. M. O., aged 46, service of Dr. Edward Martin. Patient received a blow over the left breast 17 years ago. Shortly afterward she noted a lump in the breast which did not enlarge until four months ago when it began to increase

in size and became painful. There was no discharge from the nipple, the tumor was freely movable and the axillary nodes uninvolved. The breast was removed, the pectoral muscles and the axilla were not disturbed.

The specimen (2501) showed a fibrous and cystic process which was diffuse in character. Microscopically the sections taken from different portions of the breast reveal in most places a typical appearance of abnormal involution with great production of fibrous tissue compressing the ducts, in some places giving rise to small cysts. The epithelium of the acini is hyperplastic and the basement membranes often poorly defined. In a few places the proliferation is so great and its appearance so atypical that it is impossible to interpret the processes as simply due to pressure from overgrowth of fibrous tissue. Several large masses of cells which show mitotic figures and of invasive tendency are seen. In addition to these changes in the acini other areas show papillary proliferation in the cysts; the epithelium here is quite different in appearance from that of the tubules and cysts seen elsewhere. The cells are larger, the protoplasm is pale and has a vacuolated appearance. The nuclei are small and are deeply stained. In general the epithelial growth is toward the lumen, and the basement membrane is well defined. Occasionally the arrangement is lost and the appearance is that of an epithelial invasion.

The process is regarded as malignant, and certainly suggests the multicentric origin of carcinoma in this instance, for the cancer although early, is apparently arising in two different ways: (1) secondary to acinal proliferation, and, (2) as the result of papillary proliferation.

Diagnosis: Abnormal involution (acinal and papillary types). Carcinoma.

CASE VI.—Mrs. F. M., aged 45, service of Dr. J. W. White. About one year ago noticed a small nodule at upper margin of left breast, and a few weeks later a second one in the axilla. At that time both nodules were freely movable and not painful, but later grew rapidly. About ten months later the nodule in the breast was removed and sent to this surgical laboratory and reported as carcinomatous. A few months later she entered the hospital because of the formation of other tumors in the breast, and in the axilla. At this time the mass in the breast

was firmly adherent to the surrounding tissues, the nipple and skin were retracted.

The specimen (2030) consists of an amputated breast, the elliptical section of skin measuring approximately 12 x 4 cm. in length and breadth. The nipple is not retracted, but at the opposite extremity of this elliptical section of skin there is an old scar about 1 inch long running at right angles with the long axis of the skin section. Palpation over this scar reveals the presence of a mass buried beneath the skin and superficial fascia. Incision through the pectoral muscles and fascia on the inferior aspect of the breast displays a mass about 1½ inches in diameter and of a dirty, grayish brownish coloration surrounded by a mass of white fibrous connective tissue. Incision through the tumor itself displays surfaces of a mottled, reddish and grayish coloration, the red areas being quite friable.

Microscopically the tissue in the involuting portion of the breast is very fibrous, and contains a few small cysts. In these papillæ are seen, and in others the epithelium is atrophic from pressure. The tendency toward adenomatous formation is not marked. The carcinoma appears as a dense collection of cells in which necrosis is present (medullary form) and as atypically developed acini (adenocarcinoma).

Diagnosis: Abnormal involution (proliferative form). Medullary and adenocarcinoma.

CASE VII.—Service of Dr. J. B. Carnett. Patient aged 43 years, single, has had several operations on the right breast, two cysts being removed, the tissue, however, not being examined microscopically. For several months she has suffered with pain in left breast, which on examination contained three distinct cysts, one to the inner side of the nipple, and one each in the upper and lower outer quadrants of the breast. The tumors were freely movable, the lymph-nodes not enlarged, the skin not involved. Operation: plastic resection, all glandular tissue being removed because of the extensive involvement.

The specimen (1589) consists of two masses of tissue, one about the size of an egg, the other the size of the palm of the hand. Both have the same characteristics, and contain many cysts which vary from a pea to a hazel nut in size. The tissue on section is dense in quality, fibrous, and cuts with some difficulty.

Microscopically many small cysts containing papillæ are present, the lumen of some is filled with a homogeneous secretion and desquamated epithelium. The lining cells are cuboidal in shape, the acini are increased in number and many of them are filled with cells some of which are cuboidal and others cylindrical. The epithelial hyperplasia also occurs in the form of rather cellular collections in which a few atypical acini can be distinguished. They are found in the fibrous stroma, unlimited by a basement membrane and infiltrating the tissues.

Diagnosis: Abnormal involution (acinal and papillary proliferation) Adenocarcinoma.

CASE VIII.—M. C., aged 65, service of Dr. J. H. Jopson, Presbyterian Hospital. About 10 years ago patient had the right breast amputated for carcinoma. There has been no recurrence of trouble since the operation until four months ago when she noted a lump in the upper and outer quadrant of the left breast. On palpation this was found to be tender, rather diffuse in character and freely movable. In the axilla several enlarged lymph nodes were present which seemed to be adherent to the surrounding structure. A clinical diagnosis was made of carcinoma secondary to abnormal involution, and the breast amputated.

The breast (1963) was found to be the seat of a diffuse fibrous and cystic overgrowth, and in one area a dense mass the size of a walnut was detected. The axillary nodes were hard, and of the same character as the small tumor in the breast.

Microscopically the usual picture of abnormal involution is seen, papillary and adenomatous proliferation of the epithelium is present, the papillæ almost filling some of the cyst cavities. In the immediate vicinity of the cyst, the cells have infiltrated the tissues forming carcinomatous masses in which there is an attempt to form acini. The cells in these areas are irregular in size and shape and show many mitotic figures. In the stroma leucocytic infiltration is marked.

This patient developed local recurrence and died three years later. The autopsy showed a single carcinomatous nodule in the liver, pathological fracture of the femur due to metastasis and skin metastases.

Diagnosis: Abnormal involution (papillary and adenomatous type). Adenocarcinoma.

CASE IX.—Mrs. J. G., aged 55, service of Dr. Edward Martin. The patient was admitted for removal of a growth in the right breast. This on examination was in the outer quadrant, was dense in character, the skin and nipple were not adherent, the axillary lymphatics were uninvolved. The breast was amputated, and on careful inspection did not show any gross evidences of cancer. The process present (2434) was diffuse and fibrous in nature, pinkish-white in color, and contained numerous thin-walled cysts whose contents were clear. The cyst walls were smooth and did not reveal any papillary growths.

Microscopic examination shows a marked overgrowth of the connective tissue, the nuclei being abundant showing an active proliferating process. Along with the connective tissue changes there is a considerable hyperplasia of the glandular acini which are present in great numbers. The epithelium is in an active state of proliferation; fills many of the acini, some of which are dilated. Small papillæ project into the cysts which are quite small. In the adenomatous parts some of the acini are quite irregular in shape and are closely packed together; toward the periphery of the areas the acini have no regular basement membrane. The cells are without definite arrangement in the connective tissues in some places, in others the form of acini is assumed. The epithelial cells do not show marked deviation from the normal type, although some irregularity in their size is present. About the adenomatous areas the tissues are invaded by leucocytes, and the stroma here is more cellular than elsewhere.

Diagnosis: Abnormal involution (adenomatous type).
Adenocarcinoma.

CASE X.—Mrs. J., aged 40, service of Dr. A. C. Wood. One year ago she had a small tumor removed from the right breast which on examination proved to be carcinomatous in nature. Immediate amputation of the breast was advised but refused. In a short time the growth reappeared, and X-ray treatment was begun. This was continued for a year, 80 treatments being given; the tumor, however, increased, so that surgical interference was again sought.

The breast was amputated, and on opening the axilla enlarged lymph-nodes were not found.

The specimen consists of a breast with some axillary lymphoid tissue. To the breast is attached the pectoral muscle and a

large amount of fat. The skin with nipple attached does not show any abnormal changes or retraction. Cross section through the breast shows a rather diffuse whitish infiltration which resembles the fibrous tissue changes following involution. A few small cysts are present which contain a clear secretion. At one corner of the breast directly above the pectoral muscle but not attached to it, is a nodule not larger than a pea, which is hard, indurating in character and infiltrates the breast tissue. This is the only macroscopical evidence of malignant disease which is present. The fatty tissue removed from the axilla is perfectly normal in appearance.

The sections were taken from the tumor and the fibrous tissue. In the latter the process is benign and consists of a marked fibrous overgrowth in which a few cysts appear. The acini are increased in number and in a few as well as in some of the ducts, the epithelium is proliferating, and appears as minute papillæ. The cells of these papillæ are slightly irregular in shape, and in many of them the protoplasm is quite clear. The nuclei are deeply stained and regular in size. There is no attempt in these areas for the cells to break through the basement membrane of the glands. In the stroma a round cell reaction is present.

The sections taken from the tumor show a well-advanced carcinoma which is embedded in a dense fibrous stroma. The tumor cells form rather dense masses and have undergone necrosis in many places, probably the result of the X-ray treatment. A connection between the benign disease and the carcinoma is not seen microscopically. The lymphatic tissue is normal.

Diagnosis: Abnormal involution (acinal type). Carcinoma.

CASE XI.—B. W., aged 35, service of Dr. C. H. Frazier. Has had three children but no previous breast disease. About two years ago she noticed small lumps in each breast, the growth of which have been gradual, have caused pain and have given the patient considerable anxiety. On examination, the nodules are about the size of a hazel nut and freely movable. The axillary lymphatics are uninvolved. As an abdominal operation had to be performed, it was thought advisable to remove the breasts.

On examination both breasts show practically the same characteristics, being the seat of a diffuse fibrous overgrowth in

which numerous small shot-like cysts appear. This tissue while firm is not dense in quality and contains embedded in it several small pinkish white nodules which are adherent to the fibrous stroma. These nodules are hard and dense when compared with the other process and cut with great difficulty. In the left breast, one of the nodules slightly infiltrates the pectoral muscle which is attached to the breast.

Microscopic examination of the stroma shows a slight fibrous overgrowth of the periacinal tissues, which is quite cellular. Numerous dilatations of the ducts and acini are present and in these the epithelium is heaped up in masses and in the form of papillæ. There is no evidence of malignancy until the sections taken from the small nodules are examined, when a marked cellular hyperplasia is encountered. The stroma is relatively slight in amount—the acini and ducts filled with cells and papillary formations. In the stroma, the acini are arranged in an irregular manner and much epithelium is present in small ill-defined masses. The carcinoma in the left breast is more advanced in type than that of the right.

In this case a malignant degeneration had arisen without causing any marked symptoms.

Diagnosis: Bilateral abnormal involution (adenomatous proliferation). Bilateral adenocarcinoma.

Cystadenoma.—The epithelial type of the fibro-epithelial group of tumors is less important than the fibrous variety from the standpoint of frequency, occurring in only 2 per cent. of the cases. Warren subdivides this group into fibrocystadenoma, and papillary cystadenoma.

The fibrocystadenomas are regarded as an exaggeration of the periductal fibroma from which they differ by the secondary proliferation of the epithelium. The tumors occur in young single women, are of slow growth, of long duration and are generally painless. While the prognosis is favorable in this class, the degree of epithelial hyperplasia makes a carcinomatous degeneration likely, so that removal of the tumor should always be practised.

In the papillary cystadenoma we have a more common and at the same time more dangerous affection. Clinically

we have to deal with a tumor formation seen in advanced life and especially in women who have borne children. As in the first variety, the tumor is slow in growth, of long duration, and is usually situated near the nipple, from which a bloody discharge occurs in the majority of cases. While they rarely attain large size, and are almost always slow in growth, such complications may arise and make the diagnosis of a malignant degeneration most difficult. The following case occurring in Dr. Frazier's service illustrates this fact.

CASE XII.—Surgical pathology (2562). The patient is single, 22 years of age, and has always been perfectly well with the exception of her breast condition. This began eight years ago when she noted a small lump in the right breast, which followed a blow received a short time previously. The tumor was painless and showed no tendency to grow until 18 months ago, when enlargement and pain began. This has continued until the growth is as large as a child's head and causes discomfort from its weight. The mass involves the entire breast, is not adherent to the underlying structures, and the skin is freely movable except at one point near the nipple. Several soft cystic spaces which are surrounded by dense tumor tissue are noted. There has been no discharge from the nipple, several axillary nodes are palpable. The case was regarded as malignant from the history and the entire breast and axillary lymphatics removed.

The specimen on examination shows an encapsulated mass which is neither adherent to the skin or the pectoral fascia beneath. Near the nipple a round reddish encapsulated tumor about the size of an egg is present. From the base of the fibrous capsule many fine papillæ project and almost fill the cavity. This tumor is distinct from the mass which occupies the remaining portion of the breast, which presents a dense white appearance, and is divided by numerous septa into small nodular masses. The tissue is unyielding and fibrous and in a few places only shows a tendency toward papillary formation, as in the smaller growth first described.

Microscopically two distinct processes appear to be present in the breast. Sections from the dense tissue show a process resembling periductal fibroma. Here the stroma is very cellular, indicating an active proliferative process, and surrounds the

ducts and acini. In the latter the epithelium is in a state of hyperplasia, forms a lining composed of several layers, has filled the lumen in a few acini and in others lines delicate papillæ. The cells are cuboidal in shape, regular in outline and some have the pale translucent appearance seen in proliferating epithelium. In the small tumor a similar fibro-epithelial hyperplasia is apparent, but in this case the epithelium is even more active, and papillary formation marked. The cystic spaces here are in places almost filled with papillary overgrowth, but careful examination of many slides does not show any malignant tendency in spite of the general proliferative change. The axillary nodes were not involved in a metastatic growth, but were hyperplastic.

The process is a cystadenoma in which the papillary character is seen in the small growth, the fibrous form predominates in the remaining portion of the breast.

From the very rapid growth of this tumor, its size, long duration and pain, a malignant degeneration was suspected. The degree of hyperplasia of both epithelial and connective tissues proves that such a process was imminent, and that the tumor was probably removed prior to such a transformation.

When malignancy is about to develop in such tumors, they apparently undergo a variety of changes and degeneration. Gassert¹⁹ reports a case of cystadenoma and carcinoma in which he found areas resembling the lactating breast, simple cystic dilatation, adenomatous formation with cystic degeneration, papillary proliferation and finally carcinoma. He believes that the adenomatous proliferation and the cysts were independent.

The difficulty in differentiating malignancy in early cases of this disease is emphasized by a comparison of the rapidly growing benign tumor just reported with the following instance of malignancy, in which the size, clinical history and pathologic findings of the case differ materially.

CASE XIII.—Surgical pathology (1425), service of Dr. Edward Martin. Mrs. S., aged 35, married, mother of several children. No previous breast disease. A few weeks ago she noted a small tumor in the right breast which was painless,

originated without any cause so far as could be ascertained, and was freely movable. The tumor was not adherent to the skin, there was no discharge from the nipple which was slightly inverted.

On opening the cyst which was about the size of a walnut, a bloody fluid escaped. The lining was smooth except at one point where a small papillomatous nodule, red in color projected.

Sections for microscopic examination were taken from the small papilloma and the portion of the cyst wall from which it grew. The epithelium lining the papillary projection is very irregular, appearing in one or more layers of cells which are very irregular in their shape. In other areas the papillæ have fused so that a dense collection of cells appears. In the stroma irregular acini are seen, the cells here present irregularities and do not completely surround the lumen, occasionally all attempt toward glandular formation is lost and cellular masses lie in the tissues without a limiting membrane. Some of these cellular collections containing atypical acini are found in the fatty tissue of the breast directly outside the cyst wall, and indicate that the process is extending to the surrounding parts.

Diagnosis: Papillary cystadenoma; adenocarcinoma.

A radical operation was refused in this case. Eighteen months later the patient was found to be free from any breast disorder.

The cystadenoma have been studied carefully by many pathologists and especially with the object of determining the probability of a malignant degeneration. Greenough and Simmons²⁰ found adenocarcinoma associated in 15 per cent. of twenty cases. The cancer appeared to be associated with the existence of the papillary tumor, and the type was the same in all three instances. Reliable symptoms of early malignant degeneration are wanting, for we find that the malignant papillarycystadenoma occasionally is of long duration, and may be seen at a fairly early age. The diagnosis must therefore be made at the operation, when inspection of the cyst and the surrounding tissues will reveal any infiltration. In certain cases of malignant papillomatous cysts which Bloodgood has observed, the diagnosis could be made clinically from the

history of long duration of the tumor, discharge of blood from the nipple with retraction of the same and skin involvement. Such breasts revealed a pathologic picture entirely different from benign cysts; instead of a papilloma in the wall there was a soft fungus growth resembling a medullary carcinoma. In diagnosing these cases much emphasis should be laid upon the character of the cyst contents as well as in cancer cysts to be considered later.

Cancer Cysts.—By this term is meant a malignant transformation in the wall of a benign cyst, a class of cases distinct from the cystadenomata, and the cystic changes seen in abnormal involution. While the origin of the cancerous degeneration is not quite clear, the retrogressive changes which the epithelium undergoes can be regarded as responsible. The lining cells of the cyst become compressed or atrophied, and in addition retrograde changes in the fibrous wall may occur, these factors playing a more or less important rôle in the degeneration which may follow. The origin of the cancer is not so important when once the disease is well established, for then a radical operation is indicated. The diagnosis in early cases, from the purely clinical stand-point, presents the same difficulty as is encountered in other instances of malignancy secondary to benign affections—reliable evidences of the metamorphosis are wanting. Here again the exploratory incision and examination of the cyst must be our method of diagnosis. Bloodgood²¹ states that this depends upon the contents of the cyst, if bloody and a benign papilloma is not present, a cancer should be suspected. Granular or grumous material in the cyst should lead to the diagnosis of cancer of the cyst wall. Palpation will also be of great value in detecting the presence of small carcinomatous nodules, or diffuse infiltration of the wall. In certain instances the wall becomes rough or reticulated, which in the presence of hæmorrhagic contents, as in a case I have recorded elsewhere,²² should lead to the diagnosis of cancer. In the cancer cysts in particular, Bloodgood emphasizes the greater certainty in diagnosis from the gross appearance than from rapidly frozen sections.

Mastitis.—The relationship between inflammatory affections of the breast and the development of carcinoma at a later period has been recognized for many years. Two types of mastitis are important in connection with carcinoma; in the first the inflammation is associated with a very rapid and malignant growth of the tumor, so that the entire breast becomes involved. This form is uncommon, is most frequently seen during pregnancy or lactation, which states seem to hasten the process. Volkmann has given the name "carcinomatous mastitis" to this disease; by others it has been termed "acute carcinoma."

By far the more important group of infections coming under the scope of this paper are encountered in the inflammations which occur as complications of lactation, the tissue changes resulting act as the predisposing factor in the development of cancer. A similar effect is seen in the granulation tissue caused by the healing of wounds, or hæmatomata following traumatism. The scar thus formed does not possess the resistive power of normal tissue, and constitutes a locus minoris resistentiæ. Chronic irritation then occurring in an individual whose vitality is diminished by old age may cause proliferative changes in the epithelium, which growing deeper and deeper into the breast finally become malignant and appears as a carcinoma. Guleke¹⁶ believes that the epithelium which undergoes such proliferation arises from ducts and acini which are cut off by the contracting scar tissue.

The presence of points of induration or distinct nodules as after effects of inflammation or traumatism, and the many clinical reports of carcinomatous formation in direct relationship with such areas, indicate clearly that we have to deal with a condition which may be more common than suspected. While statistics cannot be relied upon to furnish us with absolute proof of the occurrence of mastitis previous to the development of cancer, yet the reports published indicate that such inflammation has existed in 10 to 20 per cent. of the cases. The time elapsing from the inflammation until malignant metamorphosis ensues varies from several weeks to many

years, in advanced cases 20 to 30 years may elapse before severe pain and rapid enlargement indicate that carcinoma may be developing. Such symptoms, on the other hand, are not always present, for Steinthal¹⁷ records an instance in which a small carcinoma was accidentally found in a mass of chronic inflammatory tissue. Many cases of carcinoma are seen in which a previous mastitis has not caused changes in the breast recognizable by palpation. Whether the malignant degeneration here is independent of the previous inflammation or not, is difficult to determine. Scheurer¹⁸ believes that although an apparent restoration to the normal state has occurred, yet certain minute changes are present, which remaining latent for years, finally through some unknown irritation, manifest themselves as a malignant tumor.

From a practical stand-point, the question can be raised whether we are justified in permitting areas of induration to remain, especially if the patient is near the menopause. Certainly in view of the possibility of cancer, such cases should receive as careful attention as other forms of benign disease, early removal of which may prevent cancer and its greater danger.

The author wishes to express his thanks to Dr. J. W. White, Dr. Edward Martin, Dr. C. H. Frazier, Dr. A. C. Wood, Dr. J. H. Jopson, and Dr. J. B. Carnett for permission to use the clinical data of the cases reported.

ACUTE INTUSSUSCEPTION OF THE ILEUM WITH VOLVULUS.

BY CHARLES L. SCUDDER, M.D.,

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A young male adult, M. G., who had been in previous good health excepting for one attack of abdominal pain a year ago, was suddenly seized with intense pain in the abdomen upon a Monday. During the first 24 hours there were no other symptoms. The pain persisted. The man felt sick and went to bed. He was seen by a physician on Tuesday, who found that the pain was rather general throughout the abdomen below the level of the umbilicus rather than above it. There was a slight elevation of temperature—between 99 and 100 degrees. The pain persisted through Tuesday night. On Wednesday morning the patient vomited once, the temperature reached 100.2.

When I examined the patient I found the following situation: A relatively young man, under thirty, who looked sick. The tongue was slightly dry in the centre but moist on the edges. The abdomen was slightly full. The abdominal muscles were everywhere contracted so that the abdomen felt firm. No masses could be felt in the abdomen. It was possible to determine no focal point of tenderness. The patient had just previous to my examination passed a large quantity of bloody liquid from the bowel. Rectal examination disclosed nothing unusual.

We have here then, a young adult suffering from a sudden acute attack of persistent abdominal pain without marked temperature, with one bloody discharge from the rectum. The abdominal pain in the absence of fever suggested at once a mechanical obstruction to the bowel. Operation found a small amount of free fluid in the abdominal cavity. This fluid was not bloody. Below the umbilicus and at the centre of the abdomen was found a mass which consisted of an intussusception of the ileum twisted upon itself (Fig. 1). It was impossible to reduce the intussusception although the volvulus could be untwisted. The mass was

delivered outside of the abdominal cavity. The intussuscepted mass was resected and is shown in Fig. 1. The mesenteric vessels were ligated, the ends of the divided small intestine were closed by encircling purse-string sutures and interrupted sutures. A lateral anastomosis between the proximal and distal portion of the gut was then done. The abdominal wall was closed without drainage. The patient made a satisfactory recovery. (Fig. 2 shows the line of the abdominal cicatrix.) Evidently the occasion for the intussusception was the pedunculated tumor (seen in Fig. 2) which lay within the lumen of the bowel.

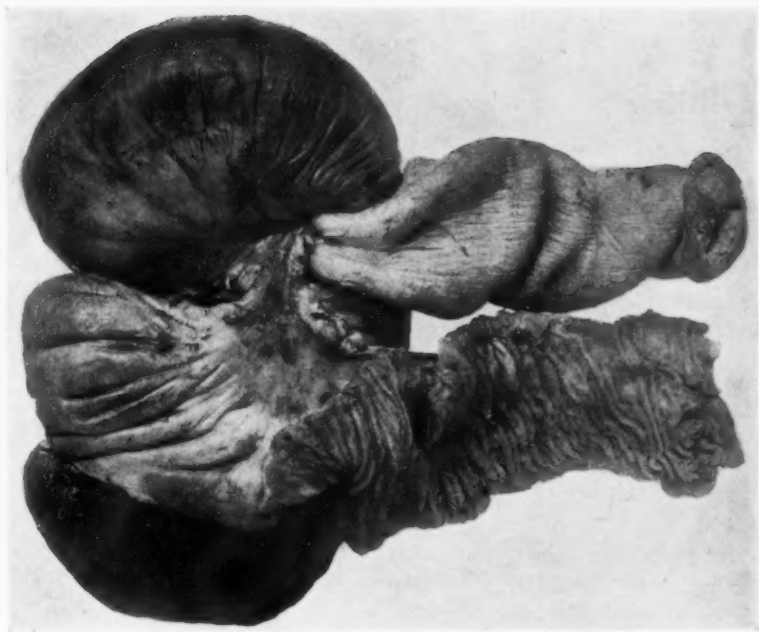
REPORT FROM THE CLINICO-PATHOLOGICAL LABORATORY OF THE
MASSACHUSETTS GENERAL HOSPITAL.

Report upon the examination of tumor in a case of intussusception and volvulus, by Dr. Oscar Richardson, the Assistant Pathologist.

Dissection of the intussuscepted intestine shows a distinct, roughly spherically shaped tumor about $3\frac{1}{2}$ cm. in diameter arising from the mucosa of the intestine on a short pedicle. The tissue of the tumor is dark blackish-red and it is necrotic looking.

Microscopical examination of hardened and stained sections shows faintly outlined, ill staining, necrotic-looking epithelium arranged in tubular formation and supported by an ill staining, necrotic-looking reticulum of connective tissue. Owing to the condition of the tissue of the tumor the sections are not as satisfactory as could be wished, but the tumor is regarded as being a *pedunculated adenoma*.

FIG. 1.



Intussuscepted mass excised. Note evident impossibility of reduction; wide margin to divided gut; lower arm of gut opened longitudinally, showing enclosed nose of intussusception.

FIG. 2.



Intussuscepted mass sectioned. The various intestinal walls can be partly traced. At lower part of specimen is seen at *T* a pedunculated tumor, the probable occasion for the intussusception.

FIG. 3.



Note abdominal cicatrix. At the middle of cicatrix was found the tumor.

A METHOD OF ANASTOMOSIS BETWEEN SIGMOID AND RECTUM.

BY DONALD C. BALFOUR, M.D.,

OF ROCHESTER, MINNESOTA,

Surgical Assistant in St. Mary's Hospital.

THE inaccessibility of tumors of the lower sigmoid at or near the junction of rectum is attested by the unsatisfactory results following the usual methods of operating on this class of cases. Resection of the growth with an end-to-end anastomosis has always been attended by a high mortality: a permanent colostomy renders the patient a nuisance to himself and friends, at least for a time; and any attempt to join the cut end of the proximal sigmoid to the sphincter means the unnecessary sacrifice of the rectum. The following method of dealing with such cases has been employed during the past three years at St. Mary's Hospital by Dr. W. J. Mayo, with satisfaction (*Montreal Medical Journal*, October, 1909).

For some years it has been the practice here when the lower sigmoid has been accidentally injured, especially where the bowel wall has been infiltrated with inflammatory products, to assist the closure of the intestinal opening by the use of a tube support. A three-fourth inch rubber tube with a lateral eye near the extremity (to permit the escape of gases should the end become obstructed) is passed through the anus and rectum up beyond the site of operation, and there anchored by a catgut stitch. This served so well to carry off the intestinal products and proved to be such an admirable splint for the sutured bowel, that the idea was suggested of using the tube following extensive resection of the sigmoid. The successive steps in the operation can be briefly tabulated as follows:

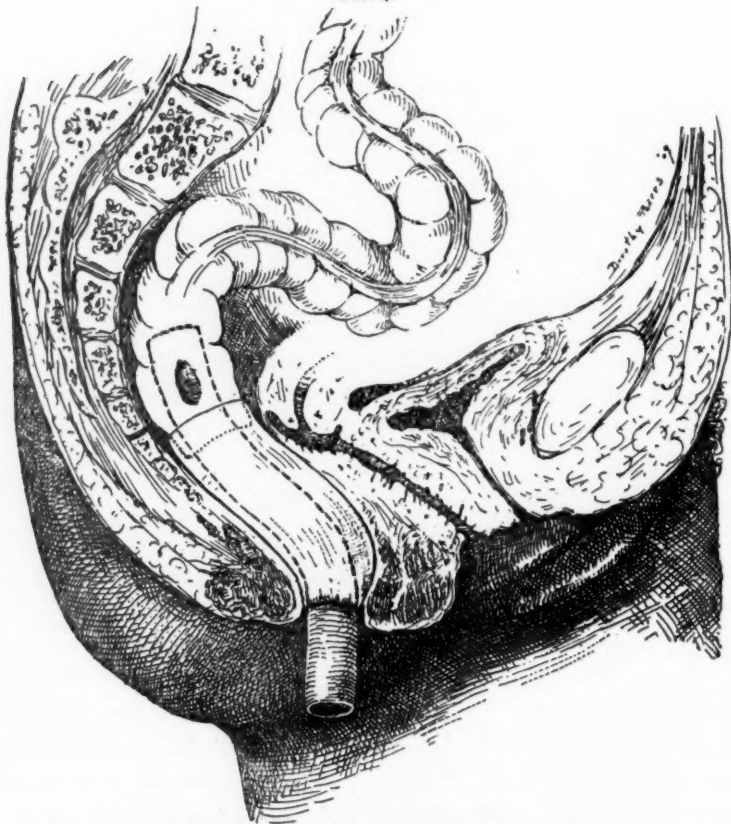
1. The patient is placed in a high Trendelenberg position

and a long median incision made between umbilicus and pubes.

2. The intestines are carefully packed off above, leaving only the lower sigmoid exposed in the pelvis.

3. Liberation of the affected portion of the bowel by lateral incisions through the peritoneum, especially through

FIG. 4.



Profile drawing of median section of pelvis showing completed anastomosis.

the outer leaf of the sigmoid, and a semilunar incision along base of bladder connecting the two lateral.

4. Careful dissection of all the fat and glands as high as the abdominal aorta, the hollow of the sacrum being swept clean.

FIG. 1.



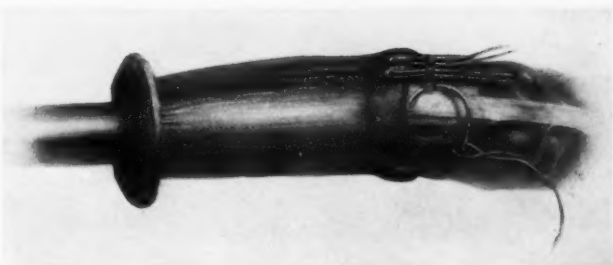
Showing tube introduced through rectum up into proximal sigmoid, and placing of catgut suture.

FIG. 2.

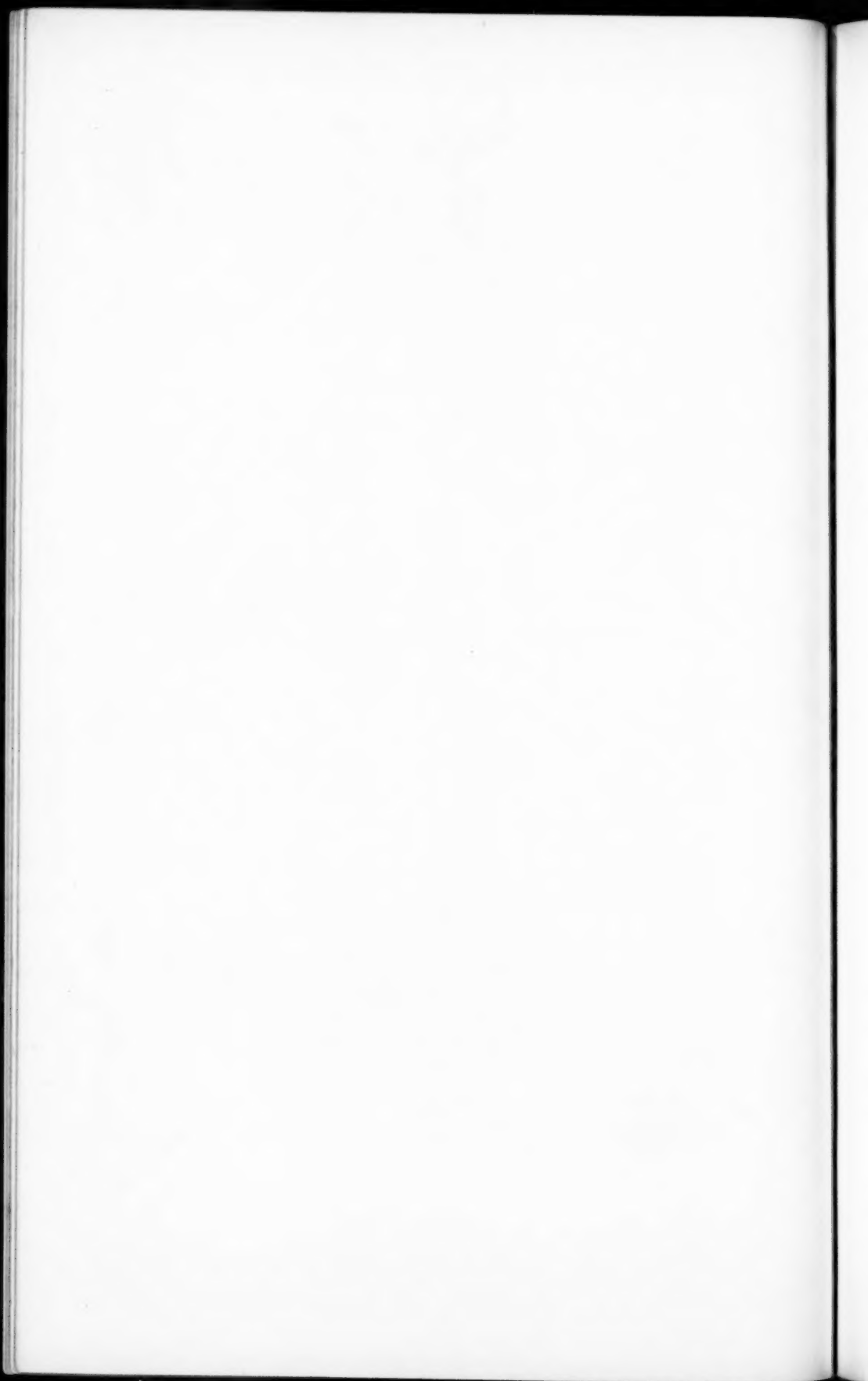


Showing tube used for bringing the two ends into apposition and first row of sutures placed.

FIG. 3.



Showing intussusception accomplished and outer row of sutures placed.



5. Ligation of the inferior mesenteric and middle sacral arteries at proper points.

6. Two pairs of forceps are clamped on the bowel at a suitable distance below the tumor and two on the proximal side; the necessary amount of sigmoid with the tumor excised, and the cut ends sterilized.

7. A three-quarter inch rubber tube is passed into the lower segment of bowel until the end protrudes through the anus: the upper end with lateral eye is inserted into the proximal end of the sigmoid to a distance of some three inches. It is here secured by a transverse catgut stitch one half inch above cut end of the intestine (Fig. 1).

8. Traction is made by an assistant upon the end of tube projecting from the rectum, until the cut ends of the bowel meet, and the anastomosis is made by interrupted through-and-through chromic catgut sutures with careful coaptation of the mucous membranes (Fig. 2).

9. Traction is again made upon the tube sufficient to accomplish a half-inch intussusception, this being aided by a few forceps on the distal fragment to steady it, and a second row of seromuscular sutures is inserted. Sometimes the parts are so deeply situated that the second row cannot be well placed, but the ultimate result has been good nevertheless (Fig. 3).

10. The defect in the peritoneum behind is remedied by sliding the peritoneum and suturing, and finally the omentum is drawn down over the anastomosis, and if necessary secured by a catgut suture.

11. The abdominal wound is closed in the usual way, drainage being provided for, as a rule, by two wicks carried down on each side of the anastomosis into the hollow of the sacrum, and brought out the lower part of the abdominal incision. The rubber rectal tube remains in position about six days, until the catgut suture is absorbed. The abdominal drains are loosened on the fourth to the sixth day, but usually not removed for a week because a temporary fistula sometimes occurs.

EXCISION OF THE RECTUM FOR CANCER BY THE PERINEAL ROUTE.*

BY CHARLES H. PECK, M.D.,

OF NEW YORK CITY.

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WHILE the combined method of excision of the rectum for cancer is ideal in its free access to the higher lymphatics and the possibility of exact determination of the upper limits of the disease or the presence of secondary deposits elsewhere in the abdomen, it has certain disadvantages as compared to the perineal route which cannot be ignored. Moreover, in a large number of growths below the middle of the sacrum (a frequent site and the only one in which the perineal route should be considered) its advantages are theoretical rather than practical, for recurrence in these cases is usually in the immediate vicinity of the primary growth. It is quite possible in these low-lying tumors to remove by the perineal route a sufficient length of bowel above the growth and also the lymphatics in the hollow of the sacrum, the real difficulty being to get beyond the disease in its immediate vicinity owing to the proximity of the adjacent organs and the lateral pelvic structures. This difficulty is in no wise diminished when the combined method is employed, for this part of the dissection is of necessity done from below. If in all cases of combined excision a permanent inguinal anus is made at the outset, as advocated by Blake, the greatest dangers of the method are obviated; but it is even then a more dangerous and severe operation than excision by the perineal route. If, after section of the bowel at or above the promontory, an attempt is made to bring

* Read before the New York Surgical Society, Nov. 10, 1909.

the proximal segment down to the pelvic floor the danger is greatly increased owing to the uncertainty of getting a sufficient length of viable gut. That a permanent inguinal anus is as satisfactory to the average patient as one at the natural site if even partial control is preserved, I cannot believe, in spite of many statements to the contrary. It is infinitely better, however, than a gaping posterior opening high in the sacral region, with no control whatever, a result sometimes seen from attempts to remove the higher growths from below,—and I believe the latter should be operated on by the combined method with the formation of a permanent inguinal anus. The two cases presented to-night upon whom I have operated during the past year and a half, will serve to illustrate some of the advantages of the perineal operation which I wish to emphasize.

The first, a man 57 years of age, was operated upon at the Roosevelt Hospital on August 19, 1908, and presented to this society a year ago. He is still without recurrence and has good sphincter control.

The second, a man 37 years of age, was operated upon at the French Hospital on January 21, 1909. He had a constricting growth about four inches from the anus, and at the time of operation, the obstruction which had developed gradually was nearly complete, and there was marked distention. A description of the operation performed will illustrate the method which I have employed.

Operation.—The patient was placed in the dorsal position, hips elevated on a sand bag, buttocks projecting well over the end of the table. The anus was closed with a purse-string suture of heavy silk. A posterior median incision was carried backward a little beyond the base of the coccyx and prolonged forward on either side of the anus as a shallow Y. The coccyx was excised, the incision deepened, and a finger hooked over the posterior border of the levator ani facilitated its division close to the rectum on either side. The rectum was then freed by blunt dissection in its entire circumference, above the sphincter, below the growth; double ligated with tape at a safe distance

from the growth, divided and the cut ends seared with the cautery. The peritoneum was then opened, gut with growth freed from bladder, prostate, lateral pelvic walls and hollow of sacrum, and drawn down a sufficient distance to allow the proximal segment to come well within the sphincter. It was double ligated above the growth, divided and cauterized. Thus far, theoretically, there had been no opportunity for contamination from the lumen of the gut. It was now necessary to open the anal segment and excise its mucous membrane. The wound was carefully protected with gauze pads, the anal purse-string suture removed and the lumen cleansed with peroxide, after which the tape ligature above the sphincter was cut away, the segment with sphincter split posteriorly and its mucous membrane excised. Without removing the tape ligature the proximal segment was brought out through the sphincter and secured with two rows of chromic gut sutures, its ligated end projecting nearly two inches. The wound closure was made by suture of peritoneal edges to the gut wall, of the cut edges of the levator ani muscles posteriorly, and of subcutaneous fat and skin. A good-sized rubber tissue and gauze drain was passed from the upper angle of the wound to the hollow of the sacrum. Complete suture of the sphincter around the bowel was not possible—a small defect being left posteriorly.

In spite of the intestinal distention present at the time of operation, the gut was left closed for forty-eight hours when, as a spontaneous opening had occurred near one of the stitches at the anal margin, the projecting necrotic portion was cut away and the bowels allowed to move. Enormous quantities of fecal matter were passed during the next two or three days, all through the sphincteric ring. The gut remained viable to a little beyond the anal margin in front, and to within half an inch of it posteriorly. The posterior suture line held throughout without infection, and there was never any fecal leakage at the drainage track. In view of the distention and marked degree of obstruction at the time of operation, I feel that the protection of the wound from fecal soiling for even forty-eight hours, was very satisfactory and an important factor in preventing infection in the wound. The patient is now well, without recurrence, has a fair amount of sphincter control and is able to follow his occupation as a waiter in a large restaurant.

With the technic described—which is simple—the perineal operation is considerably shorter and less severe than the combined operation and is applicable to a large number of low-lying growths. By leaving the bowel closed for from two to five days or even longer, a principle which I have employed for several years, healing without infection of at least the greater part of the wound can be obtained in many cases. As pointed out by Mayo, clean healing, by preventing inflammatory infiltration of the tissues about the sphincter, is probably a great aid in preserving a fair degree of control. The splitting of the anal segment posteriorly enables one to leave the anterior attachments of the sphincter undisturbed, and to thus protect at least a part of its nerve supply.

The choice of a method for excision of malignant growths of the rectum must always remain a matter requiring careful consideration in each individual case, but I believe that the perineal route is still the preferable one in a considerable number of properly selected cases.

THE TREATMENT OF GANGRENE OF THE FOOT BY ARTERIOVENOUS ANASTOMOSIS.*

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It is not necessary to refer at this time to the brilliant series of experimental observations whereby it has been shown that it is possible to divert the blood from an artery to a vein by an end-to-end anastomosis of the two vessels. The work of the experimental laboratory has been applied to the human being, and in this paper I report the tenth case in which an attempt has been made to stay the advance of gangrene of the leg.

In 1902 San Martin, stimulated by the work of Gluck, reported that he had operated upon two patients suffering from gangrene of the leg. He performed a lateral anastomosis between the femoral artery and vein. In one case amputation was performed at the same time and there was no further spread of the gangrene; the other was a complete failure. In the same year Jaboulay reported a similar operation on a patient suffering from gangrene produced by endarteritis. It was not successful and amputation became necessary later.

Hubbard in October, 1906, recorded the case of a man, aged 80, in whom he established an end-to-end anastomosis, by the invagination method, between the femoral artery and vein in Scarpa's triangle, for senile gangrene of the foot. A double anastomosis was done to effect reversal of the circulation. While no pulsation was observed, the leg did not become swollen or cold, its nourishment apparently being satisfactory. The gangrene spread until the lower half of the

* Read before the Philadelphia Academy of Surgery, November 1, 1909.

foot became blue and a line of demarcation appeared. Amputation was then performed.

Torrance in 1906 made an end-to-end anastomosis of the anterior tibial artery and internal saphenous vein in a case of crush of the foot and leg. The anastomosis sloughed.

Lilienthal in 1907 operated on a case of angiosclerotic gangrene and performed an end-to-end anastomosis in Scarpa's triangle. Eighteen hours later a line of demarcation formed, crossing the upper portion of the dorsum of the foot, thence up the sides of the leg and crossing the calf 7 or 8 inches above the point of the heel. Death occurred 31 hours after operation from shock. An examination of the anastomosis showed a smooth union with an extremely soft clot in the vein, possibly formed just before death, when the circulation was at its lowest ebb.

In 1907 Hubbard reported his second case in which the anastomosis was done by the invagination method, the distal end of the artery and the proximal end of the vein being ligated. The case was a distinct failure as it was necessary 10 days later to amputate above the knee.

In May, 1908, Ballance reported a case of arteriovenous anastomosis for senile gangrene in a woman aged 75. The gangrene began in the toes and three weeks later the skin over the dorsum of the foot began to show discoloration. An end-to-end anastomosis was performed. A few hours after operation the internal saphenous vein could be felt pulsating and visible pulsation was seen in the veins on the dorsum of the foot, but this did not persist, as two days later the pulsation was barely perceptible. "The immediate effects of the operation were striking; arterial blood was transmitted by way of the veins to the foot, the warmth of the foot was increased, the advance of the gangrene (obvious before the operation) was stayed, a definite line of demarcation appeared on the inner three toes, and the skin proximal to the line of demarcation again became sensitive so that light touches were readily located." From this time on the gangrene of the foot was arrested. Four months later the patient was seized

with acute abdominal pain and died 24 hours later. Autopsy disclosed a gangrenous condition of the cæcum, ascending and transverse colon. The anastomosis between the femoral artery and the vein was closed by scar tissue.

In July, 1908, Wieting, of Constantinople discussed the operative treatment of angiosclerotic gangrene and reported a successful case in which he intubated the femoral artery into the femoral vein. The patient, a man 40 years old, had had the right leg amputated a year previous. The foot and ankle were cold, and livid in color, and the seat of tingling pain; the patient stated it was exactly as the other foot had been at one time before the progression of the gangrene warranted amputation. Immediately following the anastomosis the foot became warm, the toes red and the pains and paræsthesia disappeared. No pulsation of the veins was seen or felt. Two months later the foot was warm and all symptoms had disappeared.

In November, 1908, Lund reported that he had operated upon a man, 32 years of age, who suffered from coldness and mottling of the foot, several sluggish ulcers on the dorsum and toes and absence of the posterior tibial and dorsalis pedis pulse. The condition had been caused by frost-bite nine months previous, although even before this he had had pain and a tingling sensation in the left foot. An end-to-end anastomosis of the femoral artery and vein was made with mattress silk sutures, everting the intima. The foot immediately turned from white to a deep pink and the superficial veins filled out. The first toe became gangrenous and was removed 11 days later and as the flaps became gangrenous the leg was amputated, three days later, 4 inches below the knee and the wound healed by first intention.

In the same year, December, 1908, Hubbard reported a third case of a woman, 84 years old, who three months before had had an amputation done of the right leg above the knee for gangrene of the foot. Subsequently a necrotic ulcer appeared on the left heel, and fearing gangrene an arteriovenous anastomosis was done according to Carrell's method. Two

weeks later the foot was warm and comfortable and the patient up in a wheel chair. Five weeks after operation "it was noticed that without any apparent reason the whole leg had become decidedly œdematous. From this time there was no very marked changes in the local condition except that a cool area about 3 inches wide, encircling the middle of the leg, appeared, while the foot and upper leg remained warm. The sloughs on the heel and over the big toe began very gradually to extend and a bed sore which developed over the sacrum showed no improvement. The general condition of the patient became gradually poorer and she gradually failed and died from senility" 9 weeks after operation. Examination of the site of anastomosis after death showed perfect healing but a thrombus at the point of union was found which was undergoing organization. The age of the thrombus could not be decided and the result was, therefore, in doubt.

The next case was reported by Armour and Smith in September, 1909. The patient, a man 69 years old, complained of swelling, cold, and feeling of pins and needles in his right foot. The arteries were tortuous and thickened, the pulse tension not high and the circulation very sluggish. The pulse could be felt in the right femoral artery but not in the popliteal below it. An end-to-end anastomosis was done and the internal saphenous ligated in the upper part of the thigh. Four days later a line of demarcation formed at the level of the upper and middle thirds of the leg on the outer side and of the lower and middle thirds on the inner side. Above this the leg was warm and the superficial veins were actively conveying blood and were somewhat distended but not pulsating. Fourteen days later the leg was amputated above the knee and when the tourniquet was loosened the tied vein was seen actively pulsating just as an artery would. The latter was filled with clot. The popliteal vein was found thrombosed below the highest set of valves.

Three weeks ago, October 7, 1909, Hubbard reported his fourth anastomosis for senile gangrene in a man aged 77 years.

An end-to-end anastomosis was done by the Carrell method. At the close of the operation the circulation in the foot returned as quickly as before. The discoloration and mottling of the foot were greatly improved but pain was marked. Later œdema of the leg appeared and pain was so great as to require morphine. About five weeks after the anastomosis, amputation above the knee was necessary owing to the pain. When the tourniquet was loosened red blood was seen to spurt from the femoral vein.

To these cases I wish to add the following:

J. F. M., aged 51 years, was admitted to Dr. Frazier's service in the Philadelphia Hospital, June 29, 1909. Two weeks before admission his left foot began to pain and tingle and to become blue, cold and mottled. When admitted he was found to have a gangrenous fifth toe and gangrenous patches on the remaining toes. He was poorly nourished, tall and gaunt and had marked arteriosclerosis of the radial and temporal arteries. The dorsalis pedis pulsation could not be felt. He was treated along the usual lines until July 19, 1909, when it was feared that the gangrenous process was advancing. On that day, under spinal anaesthesia, end-to-end anastomosis was effected, by the Carrell method, of the femoral artery and vein at the apex of Scarpa's triangle below the origin of the profunda femoris. Complete reversal was not attempted. The artery was moderately sclerosed. When the clamps were removed the vein was seen actively pulsating and continued to do so during the closure of the wound with catgut for the deeper tissues, silkworm gut for the skin. The leg and foot became warm, the leg red and the foot reddish purple in color. No visible pulsation of the veins was observed. In 48 hours the foot was cold to the ankle, the leg warm and on the third day a line of demarcation began to appear at the tibiotarsal joint. This became more marked in a few days and amputation at the middle third of the leg was advised but the patient refused to have it done. From this time until September 3, 1909 (40 days), the patient was absorbing toxin from the gangrenous foot and was gradually getting weaker. About September 1, he became delirious and, permission being obtained from his relatives, the leg was amputated 4 inches below the knee. At this time the posterior tibial and peroneal veins showed feeble but distinct

spurts of blood. There were many unusual sharp oozers. The anterior tibials did not bleed. All the arteries and the external saphenous vein were thrombosed. The internal saphenous vein was patent. The flaps were loosely sutured together and drainage provided. There was much suppuration in the flaps and despite energetic systemic stimulation death occurred, apparently from exhaustion, on September 20, 1909, nine weeks after the first operation. An autopsy was refused and we were forbidden to examine the seat of anastomosis.

If we omit the cases reported by San Martin and by Jaboulay where a lateral anastomosis was performed (this method having been shown to lead to failure), and that of Torrance which was done for crush, we have ten cases of arteriovenous anastomosis deliberately made in the hope of staying the progress of gangrene of the lower extremity.

In this series there were 7 males and 3 females. The ages ranged from 32 to 84 years and averaged 63 years. Senile gangrene was the term used for the disease for which the patients required relief with the exception of Wieting's case which was termed angiosclerotic gangrene and Lund's case which was probably obliterating thromboangitis.

The exact pathology of the various forms of gangrene is still rather unsettled, but it does not make any material difference whether the artery is obstructed by an obliterating endarteritis or simply by a sclerosis provided that thrombosis of the veins has not occurred. That thrombophlebitis is not an uncommon occurrence in gangrene has been shown by the excellent papers of Buerger, and if it should exist to any extent the performance of arteriovenous anastomosis would be foredoomed to failure. In my case I practised the method advocated by Buerger for ascertaining the patency of the deep veins and apparently found no impairment of their function.

Of the ten cases, one died apparently from shock (Lilienthal) 31 hours after operation. Three others died at periods varying from 8 to 16 weeks after operation Ballance, Hubbard's third, Müller) from causes mentioned above. Of the remaining six, Wieting claimed a perfect result two months

after operation and Hubbard's fourth case was progressing favorably until extreme pain required amputation; these were the only two cases operated upon early. The remaining four (Hubbard's first and second, Armour and Smith, Lund) required amputation either at the "point of election" or above the knee at varying periods after the anastomosis.

"If we deflect the arterial current from the femoral artery into the femoral vein, below the termination of the long saphenous, we do so with a view to establishing the following conditions: (1) the deep veins are to be transformed into arteries; (2) the blood must find its way into the capillaries where it meets the blood from the profunda and the capillaries; and (3) a new centripetal flow must be established, primarily through a set of interanastomosing deep venules, but in the main finding its way into the vast network of superficial veins that empty in the long saphenous and thus into the femoral." (Buerger.)

There are, of course, two serious objections, theoretically, to the success of the operation: (1) the presence of valves in the popliteal vein and (2) the obstruction in the arteries tending to drive the blood from the deep to the superficial veins before the capillary system is reached. In 1903 Gallois and Pinatelle stated that according to their experiments the valves formed an insuperable obstacle to arteriovenous anastomosis, but Carrell has shown that the living tissues have great power of adaptation and that the valves are forced in a few hours, thus allowing for the reversal of the circulation.

As to the second objection the cases on record show that the blood *does* reach the tissues of the foot, but I am of the opinion that if the tibial arteries are occluded the blood barely reaches the dorsum and simply suffices to insure nourishment to the tissues at the "point of election" for amputation. It has been proposed (Buerger) that the ligation of the external saphenous would enable more arterial blood to reach the leg and foot, but it has not been performed in the cases on record. Armour and Smith ligated the internal saphenous but accomplished nothing, nor is this procedure to be recommended, as the long saphenous is needed as the efferent trunk where

complete reversal of the circulation is impossible by reason of the obstructed arteries.

An objection has been raised by Ross that division of the artery and vein destroys the *nervi arteriorum* and that the loss of tone thus induced must favor thrombosis and that, therefore, the effect of the operation is exactly as in ligation, the collaterals supplying the blood to the tissues below. But I think it is pretty well established by the experimental work that the plexi surrounding the vessels must be to a great extent automatic in action and not dependent entirely upon impulses from the sympathetic and spinal fibres. There is undoubtedly some change in the nutrition of the vein wall and this, together with the changed conditions of pressure, results in an increase in the thickness of the wall of the vein.

Finally I would offer in conclusion:

1. That in the early stages of arterial disease producing ulcers on the toes, erythromelia, extreme pain, tingling, etc., a complete reversal of the circulation *may* relieve the condition if other measures have been tried and failed.
2. That with gangrene of a toe established, one should wait for a line of demarcation. If the process involves several toes or tends to spread to the dorsum of the foot an anastomosis between the femoral artery and vein with ligation of the external saphenous *will almost certainly* induce a line of demarcation in the region of the ankle.
3. That if the superficial and deep veins are also thrombosed the operation is useless and should not be done.

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TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, November 10, 1909.

The President, DR. JOSEPH A. BLAKE, in the Chair.

CRANIOTOMY FOR CEREBELLAR CYST.

DR. CHARLES A. ELSBERG presented a man of 22 who was admitted into Mt. Sinai Hospital in May, 1909, with the history that six weeks before he had begun to suffer from occipital headache and to have attacks during which he saw double. The headache became more severe, and was accompanied by vomiting. For the past three months he had been deaf in the right ear, and his eyesight had become much impaired.

When admitted to the hospital, the patient had coarse nystagmus to the right, marked weakness of the right external rectus muscle, areflexia of the right cornea, weakness of the right facial muscles, slight weakness, ataxia and hypotonia in the right upper and lower extremities and exaggerated knee-jerks. There was marked choked disc on both sides.

During one week the symptoms became much aggravated, so that operative interference became imperative. The diagnosis of a lesion in the right cerebellar hemisphere was made, and a right suboccipital craniotomy, with removal of the bone, was performed. The right cerebellar lobe was found to contain a cyst the size of a goose egg. The cyst was opened and its contents evacuated, the cavity swabbed out with the tincture of iodine, and the dura and skin flaps sutured into place.

The patient made an uneventful recovery from the operation. When presented, he was free from all symptoms and was entirely well. His eyesight was normal, and the paralysis of the right external rectus, the areflexia of the cornea, the ataxia and weakness of the extremities on the right side had entirely disappeared.

DR. ELSBERG presented another patient upon whom he had

operated for cerebellar cyst, and who was well after one year. The history of this second patient was similar to that of the first with the exception that there had been marked mental disturbance and very little optic neuritis. The left cerebellar lobe contained a small cyst which was probably due to an old hemorrhage. In this case, the operation was done in two stages: the first consisted of removal of the bone, the second of the opening of the dura, the examination of the cerebellopontine angle, the incision of the hemisphere and the evacuation of the contents of the cyst.

The patient made a very satisfactory recovery from the operation; the mental symptoms disappeared rapidly the day after the operation, and with the exception of a persisting slight ataxia in the left lower extremity, the patient was perfectly well.

HEMITHYROIDECTOMY AFTER LIGATION OF THE SUPERIOR THYROID VESSELS FOR EXOPHTHALMIC GOITRE; HYPERTHYROIDISM.

DR. ELSBERG presented a woman, 35 years old, in whom, for the relief of a severe form of Basedow's disease, he had ligated the superior thyroid vessels four months before under local anæsthesia and had sent the patient to the country for a rest. A month later the patient returned to the hospital with her symptoms unrelieved. Under ether anæsthesia, the right lobe of the thyroid was removed without difficulty. An hour after the operation the patient had a pulse of 240, with great dyspnœa and delirium. Severe symptoms of hyperthyroidism persisted for two days; they then gradually disappeared, and the patient thereafter made an uninterrupted recovery. All of her symptoms disappeared within two months: the pulse was now slow and regular, the exophthalmus had disappeared, there was no longer any tremor and the patient had gained more than thirty pounds in weight and felt perfectly well. In this case there was absence of a lymphocytosis in the blood—a condition which Kocher considered of grave prognostic significance.

HEMORRHAGE INTO THYROID CYST; HEMORRHAGE INTO OVARIAN CYST.

DR. ELSBERG presented a young woman who was admitted into Mt. Sinai Hospital with severe dyspnœa from a large swelling of the thyroid gland, of two hours duration. Under ice appli-

cations the swelling was partly reduced, and the interference with breathing overcome. The right lobe of the thyroid was exposed, and a cyst which contained a large recent blood clot was removed. The patient made an uneventful recovery, and was discharged well two weeks after the operation.

Two weeks later she was readmitted with acute abdominal symptoms of a few hours duration. At the operation, a large ovarian cyst filled with a recent blood clot was removed. The pedicle of the cyst was not twisted and looked normal. From this operation the patient also made a good recovery. Two months later she returned with similar symptoms on the opposite side of the abdomen. She refused operation and left the hospital against advice. Her symptoms gradually disappeared.

This patient, Dr. Elsberg said, had had an attack of articular rheumatism some weeks before the hemorrhage into the thyroid cyst had occurred, and the connection between rheumatism and hemorrhage into thyroid cysts was well known. It was of interest that there seemed to exist in this patient a tendency to bleeding into existing cysts. There was no other hemorrhagic tendency.

MODIFIED TALMA OPERATION FOR CIRRHOSIS OF LIVER AFTER THREE YEARS.

DR. ELLSWORTH ELIOT, JR., presented a man, 55 years old, who was admitted to the Presbyterian Hospital on October 9, 1906. He had been a moderate drinker, and gave no specific history. Four years before he had symptoms of indigestion, from which he completely recovered. One year later he had a second similar attack, with loss of appetite and fever, associated with swelling of the legs and abdomen. A course of treatment with hot baths improved his condition to such an extent that he could work the following summer. Two months later his symptoms recurred, and since then he had done no work.

Eighteen months before admission his abdomen was tapped for the first time, and since then this had been repeated about twenty times, from three to six gallons of fluid being removed at each tapping, with some relief to the patient. More recently he had suffered from dyspnea, and his general condition was not so good.

Operation by Dr. Eliot, October 16, 1906: Through an

incision midway between the symphysis and umbilicus all fluid was evacuated. The thickened omentum together with the gut adjacent was then sponged off and allowed to come in contact with the wound, and after the insertion of a long cigarette drain to the bottom of the pelvis, the wound was closed.

After the operation, the patient's general condition was satisfactory. There was a very free serous discharge from the wound for ten days, when it suddenly ceased. Three weeks after the operation the ascites had recurred to a sufficient degree to give rise to a fluid wave, but this gradually disappeared in the course of a week, the patient passing large amounts of urine. During the three years that had elapsed since the operation there had been no further recurrence of fluid. The patient was able to travel and do a moderate amount of work. Eighteen months ago he returned to the hospital on account of irregular heart action and dyspnœa, and he was discharged at the end of three weeks much improved. His liver now was smaller than prior to the operation, but it still projected below the free margin of the ribs and had an irregular surface.

Dr. Eliot said he had another case, a woman, upon whom he did this operation four or five years ago, and who was still alive and able to do her housework. More recently, however, he had discarded this operation because of the rather high mortality. For a time, he thought the high death rate might be due to the use of a general anæsthetic, and he did the operation under cocaine, but the results were still unsatisfactory. For the past year he had given up the use of drainage altogether, making his incision above the umbilicus, allowing the greater part of the fluid to escape, suturing the omentum to the abdominal wall between the parietal peritoneum and the posterior sheath of the rectum and then closing the wound without drainage. With this method, his mortality was considerably less, but at the same time it had not produced so rapid a cure, for the fluid recurred, necessitating an occasional tapping, but at much longer and increasing intervals than before the operation, until finally, with the establishment of a satisfactory venous collateral circulation further recurrence ceased.

DR. CHARLES N. DOWD said he had done one of these operations in a manner similar to that described by Dr. Eliot, suturing

the omentum into the abdominal wall and then closing the wound. The ascitic fluid was withdrawn by tapping as it accumulated. This, however, was not necessary for a very long time, and an ultimate cure resulted.

DR. ALEXANDER B. JOHNSON said that while he agreed with Dr. Eliot that the mortality of this operation was considerable, yet the result in a certain proportion of cases was extremely gratifying. He had a woman under observation upon whom he had done the operation at least five years ago who at the time of the original operation was in a pitiable condition. He had seen this patient within the year, and during the four years that had elapsed since the operation she had never required another tapping. While the abdomen contained a small amount of fluid, the patient's general health was good; she was able to resume her household duties and she had improved to such a degree that one would scarcely have recognized her. In that case he had simply rubbed the diaphragm and liver with a nail-brush, and sutured the omentum to the abdominal wall.

In another case, a man with a marked alcoholic habit and cirrhosis, the abdominal cavity contained a large quantity of fluid and the general health of the patient was much impaired. He sutured the shriveled omentum to the undermined subcutaneous tissues of the abdominal wall and the patient recovered a fair degree of health. When he returned a year later to have an umbilical hernia operated on there was a very small amount of fluid in the abdomen. The hernia was operated on successfully and the man was still in fairly good health.

In a third case, Dr. Johnson said, he did the regular Talma operation, and during the year and a half that the patient was kept under observation there was no necessity for retapping, and the patient was able to resume his work and enjoyed very fair health.

RESULT OF OPERATION FOR HEPATOPTOSIS AFTER FIVE YEARS.

DR. ELLSWORTH ELIOT, JR., presented a woman who was admitted to the Presbyterian Hospital December 7, 1903. She was then 38 years old. She had had two pregnancies, nine and seven years before. Eighteen years previously she had had an attack of severe pain in the epigastrium, with jaundice, confining

her to bed for three weeks. A similar attack occurred three years before admission, with severe pain in the right hypochondrium, and vomiting. The jaundice persisted for a month. In November, 1900, a ventral fixation was performed by Dr. Eliot. At that time there was retroflexion and some menstrual difficulty, which was relieved by the operation. In April, 1903, the patient had an attack of fainting, with chills and fever, and severe pain in the back, but no vomiting nor jaundice. Since then she had had frequent attacks of fainting, with abdominal pain after eating, and occasional jaundice. For several months past she had been unable to do any heavy work.

On examination, the wall of the abdomen was soft and retracted. The lower border of the liver could be felt two inches below the free costal margin. On bimanual examination, in the right lumbar region, the right kidney could be felt to be slightly movable.

Operation: On opening the abdominal cavity, the transverse fissure of the liver was found to be in close contact with the lesser curvature of the stomach. The greater curvature was opposite the umbilicus. The right kidney enjoyed an excursion of two inches during inspiration. The gall-bladder and ducts were normal. The liver was raised a distance of two inches by suture of the round ligament, and the abdominal wound was closed after denudation of the opposed peritoneal surfaces of the diaphragm and liver.

No unusual nausea or vomiting followed the operation. The bowels moved on the third day. The pain decreased and finally disappeared, with steady improvement of the appetite. On the tenth day, slight pain in the back alone remained. The patient continued to improve, and left the hospital in excellent condition. Six months after the operation she was enjoying very good health. There was occasional pain after eating and some obscure pain low down in the pelvis, but her general condition remained greatly improved.

He had seen this patient from time to time during the past five years, and the improvement in her condition had continued, so that she had been able to do her household work and support her family. She still had occasional attacks of abdominal pain, but these were not severe, and her attacks simulating gall-stone colic had entirely disappeared.

CALCULOUS PYONEPHROSIS: NEPHRECTOMY.

DR. ALEXANDER B. JOHNSON presented a man, 51 years old, who was admitted to the New York Hospital on March 23, 1909, with the diagnosis of renal calculus and pyonephrosis of the right kidney. The case was shown to illustrate the frequent error in diagnosis made when the symptoms of a kidney lesion were referred almost entirely to the bladder and urethra.

The previous history of the patient was as follows: Twenty-five years ago he had a specific urethritis and since that time he had suffered from urinary disturbances consisting of frequent and painful micturition, with (as was alleged) occasional attacks of retention of urine. During the greater part of this time he had been treated for stricture of the urethra by gradual dilatation. For the past two years he had suffered from occasional attacks of severe pain in the right lumbar region.

During the past twenty-five years the patient's urine had been constantly loaded with pus. For the past two years the quantity of pus had greatly increased and for the past six months he had had a continued fever of a septic type, and had rapidly lost flesh and strength.

Upon admission to the hospital, the patient's general appearance was that of a man seriously ill with chronic septicæmia; his skin had an ichteroid tinge, his breath was foul, his tongue was coated, he was markedly anæmic, his urine was heavily loaded with pus and had a musty odor, with a specific gravity of 1016. It contained many colon bacilli; no tubercle bacilli.

In the right loin a tumor of considerable size was palpable; it was tender and gave the characteristic signs of an enlarged kidney. Dr. Johnson said the patient had been referred to him by Dr. Roper, the Associate Attending Physician to the New York Hospital, who had made a diagnosis of probable suppurative lesion of the kidney and had had a radiograph of the kidney region taken by Dr. Caldwell. This picture showed a large branching calculus in the right kidney.

Upon exposing the right kidney, it was found to be composed of a thin-walled sac, from which all secreting substance had disappeared. Its capsule was very tough and adherent, and during its removal it ruptured and the wound was bathed with pus. The ureter was much enlarged and dilated, but basing his action upon his experience with former cases of this character, Dr.

Johnson decided that it would not be necessary to remove more than a small portion of it.

The patient made a good convalescence, and left the hospital at the end of about thirty-three days. At that time his urine still contained a large amount of pus, which probably had its source in the remnants of the dilated ureter. As the latter contracted, the amount of pus gradually decreased, and the patient's urine to-day was almost entirely clear. His general health at present was excellent, all urinary symptoms had disappeared and examination showed that he had no stricture of the urethra.

CARCINOMA OF THE RECTUM; UNUSUAL METHOD OF ANASTOMOSIS.

DR. JOSEPH A. BLAKE presented a man 50 years old, who was admitted to the Presbyterian Hospital on May 20, 1909, suffering from adenocarcinoma of the rectum which had given symptoms of hemorrhage and partial obstruction for about seven weeks. The examination revealed a growth extending upward about three and a half inches above the anus, and therefore above the levator ani muscle.

Operation, May 25, 1909: The abdomen was opened through a median suprapubic incision eight inches long, with the patient in the Trendelenburg position. The growth was found to lie above the level of the reflexion of the peritoneum on the levator muscles, and it occupied about two inches of the length of the intestine. The superior hemorrhoidal arteries were located and tied, and the left ureter identified. About eight inches of the intestine, including the growth, was then excised, together with the retroperitoneal tissue. This was done in the following manner:

The lateral reflexions of the peritoneum having been divided, the gut with its lymphatics was loosened from its bed. Double heavy silk ligatures were then placed about the gut at the points of division, and securely tied. The gut was then divided between them with the Paquelin cautery. It was then found that the ends could be easily brought together, but that there was not sufficient room above the levator ani muscle to carry out an end-to-end anastomosis without great difficulty and soiling of the wound. Therefore, with some misgiving, the cut-off ends, including the ligatures, were stitched together, and the upper and lower segments of the gut were united about them so as to infold the closed ends. Interrupted silk sutures were used for this purpose.

This re-established the continuity of the bowel, with the exception that its lumen was closed by a double diaphragm consisting of the tied ends. The peritoneal reflexions were sutured over the intestinal anastomosis so as to exclude it from the peritoneal cavity. A stab-wound drainage, with a double rubber drainage tube, was carried up from behind and to one side of the rectum to the line of suture. A left inguinal lateral colostomy was made by suturing the sigmoid flexure into a small intermuscular wound, and introducing a tube into the intestine. The abdominal wound was then closed without drainage.

After the operation, which consumed over two hours, the patient's condition was good. At the time of the operation there was considerable doubt as to whether the ligatures tied about the end of the intestine would cut through and the continuity of the canal be re-established. If this did not occur, it was Dr. Blake's intention to break through from below at a later date, when the wound surface had commenced to granulate and infection would therefore be limited. This was found to be unnecessary, as the ligatures and part of the suture line gave way, so that the fæces began to come through both the drainage wound behind the rectum and through the anus itself on the fourth day. At first there was as much fecal discharge from the drainage wound as there was from the anus, but the former gradually closed and in four weeks' time the entire fæces escaped through the normal passages. The colostomy wound closed of itself.

The patient was discharged from the hospital on July 3, 1909, with normal defecations. There was a postoperative rise of temperature to 101.5, and a return to normal on the sixth day. After that there was a more or less continued temperature from infection of the perirectal tissues, but this gradually subsided.

The histological examination of the growth showed it to be an adenocarcinoma.

At the present time, nearly six months after the operation, there is only a slight narrowing of the calibre of the intestine at the point of anastomosis.

In discussing this case, Dr. Blake said it probably would have been better if a complete colostomy had been done, so that the fecal current would have been entirely diverted from the lower bowel. Healing would then probably have proceeded with less infection.

EXCISION OF THE RECTUM FOR CANCER BY THE PERINEAL ROUTE.

DR. CHARLES H. PECK read a paper with the above title, for which see page 242.

In connection with his paper, Dr. Peck presented two patients upon whom he had operated by this method.

DR. ARPAD G. GERSTER said he thought the most notable feature of the operation described by Dr. Peck was to leave the gut closed after the proximal end had been stitched into the sphincter. This had been found very useful to prevent early infection of the wound, which was most to be feared in the after-treatment.

DR. FREDERIC KAMMERER said that during the past few years he had practically abandoned the operation of resection of the rectum. In his experience, he had only had one case of resection without a preliminary artificial anus in which primary union had occurred throughout. Generally, the sutures gave way at the posterior border of the bowel, where there was no peritoneal covering, and these posterior fistulæ were not so easy to close as one would be led to believe from a perusal of the literature on the subject. As a matter of fact, the correction of deformities resulting from infection and the separation of sutures in amputations as well as resections of the rectum was one of the most difficult problems of plastic surgery. Of course, such mishaps could be to a great extent avoided by establishing a preliminary artificial anus, which, however, condemned the patient to three distinct surgical procedures, a point worthy of consideration.

Dr. Kammerer was furthermore inclined to believe that recurrences were more frequent after resection than after excisions. Considering everything, the best results could be obtained, in his opinion, by the establishing of a permanent inguinal anus and the excision of the rectum, the question being simply how that was best accomplished. He had, during the past five or six years, established a permanent inguinal anus in every case of cancer of the rectum, even of the third uppermost portion. If it appeared necessary, a digital exploration of the pelvis, to determine the question of a possible radical operation and the presence of secondary deposits higher in the bowel, might be made at this time, an advantage claimed for the first step of the

combined operation. After two or three weeks the tumor was then removed by the posterior or sacral route, the lower portion of the bowel having been meanwhile irrigated with normal salt solution several times a day. The change that would very often occur, not alone in the condition of the patient, but also in the size and mobility of the tumor under this treatment was a point not sufficiently insisted on in late surgical literature.

The objections generally raised against preliminary colostomy were the three operations, as against one in the case of a temporary anus, and the fixation of the loop in the inguinal region, preventing a drawing down of the upper end of the bowel to the anus or sacrum after removal of the tumor. The first of these objections has fallen with the permanency of the artificial anus, and as to the second, Dr. Kammerer's experience had taught him that it was much exaggerated. However, in doing a secondary excision it is only necessary to close the stump of the rectum with sutures and to attach it to the incised peritoneum of Douglas' pouch. There is no occasion for an approximation of the stump to the original anal orifice.

This procedure may not be as brilliant as the combined operation in one sitting, but it is an eminently safe operation with a very low mortality, indeed, and it accomplishes practically the same thing. The small stump of the sigmoid that remains had never proved a source of annoyance in the speaker's cases. As a matter of fact, an exploration of the pelvis later on was possible through this opening, when the natural anus is missing.

DR. L. W. HOTCHKISS said that in two of his cases where he brought down the divided segment of the gut through the anus with excision of the mucosa, sloughing occurred at the posterior point of union, as it usually did. In both instances, however, the wound had healed by granulation. In one of these cases seven years had now elapsed without any recurrence, and in this case there was originally a small stricture, which was easily dilated by means of bougies and gave no further trouble.

Dr. Hotchkiss said that if it was possible to secure union between the cut ends of the gut above the sphincter, without complete division through the sphincter, the functional results were generally very much better.

DR. JOHN A. HARTWELL said he wished to emphasize the importance of the points brought out by Dr. Kammerer. Three

or four years ago he read a paper on this subject before the New York Surgical Society in which he reported about fifty cases of cancer of the rectum collected from the work of seventeen different surgeons, and of that number of cases the cures after three years were less than 20 per cent. The recurrences were practically all local. In most of the cases that had been reported at the present meeting, the time that had elapsed since the operation was too short, though the primary results were most satisfactory. Personally, he was in favor of a preliminary colostomy, in order to get the patient into the best possible condition, and he was opposed to cutting too close to the malignant growth. In these operations, in considering the immediate comfort of the patient, we should not lose sight of the ultimate outcome. Excision of the whole rectum for any growth that can be reached with the finger from the anus is better than resection and anastomosis.

DR. BLAKE said he had come to the conclusion that the better operation was to excise the entire growth with the end of the bowel. His own procedure had been to establish an artificial anus at the time of the operation. He had operated on twelve or fourteen cases by this method, without mortality. In the case he had shown at this meeting, Dr. Blake said, the patient had told him that there was a slight narrowing at the point of junction, and it was possible that a stricture would develop later on.

DR. HOTCHKISS said the point had been raised in regard to bringing down the sigmoid, whether the operation was done by the high or low method. The old method of skinning back the peritoneal investment was apt to give rise to necrosis and the same was true if the mesocolon was ligated too close to the bowel. The further back from the gut the ligature was placed, the less tendency there was to necrosis.

DR. PECK, in closing, said he had had one rather disastrous result in a combined operation, in attempting to tie the vessels some distance back, near their origin, in the hope that the circulation would be established in the gut below through the loops. Having been rather impressed with the favorable reports of that method, he ligated the vessels close back to their origin. The result at first seemed to be satisfactory, but death from necrosis occurred six days after the operation. That case, he thought could have been saved by an operation from below, or by estab-

lishing a permanent inguinal anus. That experience had discouraged him from further trials of that method, which was advocated by Moynihan.

In regard to splitting the sphincter posteriorly, he favored that method because it gave a rather free exposure and afforded a better opportunity for excising the mucous membrane.

Stated Meeting, November 24, 1909.

The President, DR. ELLSWORTH ELIOT, JR., in the Chair.

CHOLECYSTECTOMY FOR CHOLELITHIASIS.

DR. ALEXANDER B. JOHNSON presented a man, 34 years old, who was taken sick two weeks prior to his admission to the New York Hospital with a dull, aching pain in the right hypochondrium. It shifted for a short time to the epigastrium, but soon reverted to the first location, where it had persisted. He had vomited once with the onset of the pain. There was no history of jaundice; no definite chill nor sweating.

Upon examination, there was slight rigidity and the sensation of a rounded, smooth mass, about as large as a medium sized orange, in the right hypochondrium. The mass, which was not very tender, seemed to extend about two inches below the free margin of the ribs, just below the position of the gall-bladder. The abdomen was otherwise normal, and there was no rigidity outside of this area.

On October 18, 1909, the gall-bladder was exposed through an incision three inches in length. It was then found that the mass was composed largely of adherent omentum, which was in a condition of inflammatory infiltration. Upon separating the adhesions, the gall-bladder was found to be much enlarged; it was necrotic in spots and almost ready to perforate. Upon aspiration, its contents were found to be purulent. The pedicle of the gall-bladder was then clamped, and the sac removed *in toto*. The orifice of the cystic duct was sutured to a piece of rubber tubing which was left for drainage, and the wound was then closed.

The patient made a good convalescence, although he still had a biliary fistula which was rapidly closing. Drainage of the

cystic duct was continued for nine days, and there were no further evidences of infection of the biliary passages. The wound healed by primary union throughout and the patient was now in good condition. The excised gall-bladder was found to contain about 163 stones, nearly all of the same size and shape; *i.e.*, imperfect cubes, the sides one-third inch in length.

FRACTURE OF THE ANATOMICAL NECK OF THE HUMERUS,
WITH DISLOCATION OF THE HEAD INTO THE AXILLA.

DR. JOHNSON also presented a woman, 63 years old, the widow of a physician, who four weeks prior to her admission to the New York Hospital fell in alighting from a railway coach, a distance of about $2\frac{1}{2}$ feet. She struck upon her left shoulder, side and hip. Upon rising, she noticed that her left arm, aside from paining her very severely, was fixed in a slightly abducted position. She consulted a physician, who manipulated the arm and succeeded in getting it adducted, although he heard no click as if the head of the bone had slipped back into the glenoid cavity. Three weeks later the arm was again manipulated for diagnostic purposes, without any result.

When Dr. Johnson first saw the patient, the arm was fixed in a fairly normal position. There was a slight forward axial deviation of the shaft of the humerus. There was no inward displacement of the upper extremity of the shaft; no crepitus nor false point of motion. On passive rotation the tuberosities moved with the shaft. The head of the bone was felt in the axilla. Two X-ray pictures were taken, which established the diagnosis of a fracture through the anatomical neck of the humerus, with dislocation of the head into the axilla.

An operation for the removal of the dislocated head was done eleven days ago by Dr. Johnson, and considering the brief time that had elapsed, the result was very satisfactory. The dislodged head of the bone was approached by a curved incision through the pectoralis major muscle. This exposed the brachial plexus and the axillary vessels, which had to be drawn inward before the bone could be seized and extracted with the lion-jawed forceps. An axillary drain was inserted, which was removed on the second day, and the wound healed in five days. The intense pressure pain from which the patient had suffered was immediately relieved by the operation, although she still

complained of some tingling in the distribution of the ulnar nerve. There was no actual anaesthesia nor definite loss of power.

Dr. Johnson said he hoped that with time and use and under suitable local treatment, the loss of function entailed by the injury would be greatly diminished. So far as he had been able to learn less than 40 of these cases were reported in surgical literature in which the diagnosis had been verified by operation, and the total number, whether verified or not, was under 50.

DR. ELLSWORTH ELIOT, JR., said he had seen two cases of fracture of the anatomical neck of the humerus, with dislocation of the head into the axilla. One of them, which he still had clearly in mind, was operated on three months after the accident. The head of the bone was in the same position as that in the case shown by Dr. Johnson, and over it was stretched the neurovascular sheath. The glenoid cavity was filled with reparative material. The head of the bone was removed, and three years later the movements of the affected arm were equal to those on the opposite side. In this case the pointed extremity of the lower fragment was brought into apposition with the partly obliterated glenoid cavity, and this had evidently established a satisfactory joint. In his second case, Dr. Eliot said, the head of the bone was also removed, and when the patient left the hospital there was a considerable range of motion, especially of abduction, which was the most difficult movement to recover.

CYST OF THYROGLOSSAL DUCT.

DR. ALFRED S. TAYLOR presented a man of 40 years who for three years had had a cyst just above the larynx which gradually became more annoying, so that he asked to have it removed. The operation for this purpose was done on June 18, 1909. A transverse incision was made over the cyst, which extended from the upper border of the larynx to the under surface of the hyoid bone. From this point a small fistulous opening penetrated the hyoid bone and extended to the base of the tongue. The cystic growth was shaped somewhat like an Indian club above the hyoid and ran up to the dorsal surface of the tongue. The cyst below the hyoid had pushed the thyrohyoid membrane backwards until it almost touched the posterior wall of the pharynx. Although the patient is a singer this had not interfered with his voice. The cyst was entirely removed, no drainage was used,

and primary union resulted. The scar can now scarcely be found.

DR. ELIOT said that in young people, particularly, it was quite possible to remove that portion of the cystic tract that penetrated the hyoid bone, as in the case shown by Dr. Taylor. In one case that came under his observation in a child of six or seven years, the hyoid bone was easily divided, and the cyst in its centre was removed. The portion of the cyst behind the bone was then readily removed, and at the completion of the operation the divided hyoid bone was sutured, rapid union taking place, with complete restoration of function. The speaker said he did not know whether after a similar procedure in an adult union could always be relied upon.

PERFORATING DIVERTICULUM OF ASCENDING COLON.

DR. JOHN A. HARTWELL presented a woman, 43 years old, who was admitted to the Presbyterian Hospital on August 30, 1909. For the past ten years the patient had suffered from attacks of abdominal pain coming on at night, which were usually relieved by vomiting. The pain was general in character, but more severe in the epigastrium. It recurred two or three times yearly. Two years ago she had her first attack in which the pain was localized in the right lumbar quadrant; this was accompanied by fever and vomiting and lasted one week. Since then she had had similar attacks every three or four months. She was constipated. Blood had never been noticed in the stools.

The patient, upon her admission to the hospital, was fairly nourished, and her general appearance was good. Examination of the abdomen revealed a mass in the right lumbar quadrant; this was hard, and firmly adherent to the border of the ileum. The vagina and uterus were somewhat fixed posteriorly, and there was tenderness in both quadrants.

Operation, September 12, 1909: After a preliminary curettage of the uterus, Dr. Hartwell made a midsuprapubic incision. The uterus was found to be fixed posteriorly by recent adhesions; there were small cysts in each ovary, and a larger one, about the size of a walnut, in the left broad ligament. The cysts were removed, and the uterus lightly suspended. An intermuscular incision was then made over the mass, which was found to consist of the appendix turned up outside and behind the cæcum and

colon, and buried in adhesions. The appendix was greatly thickened, but not acutely inflamed. Its tip was buried in a thickened, hard mass in the wall of the colon, just anterior to the outer half of the mesentery, and when it was dug out the mass was found to have a perforation large enough to admit a probe, which communicated with the lumen of the bowel.

The appendix was removed, and the thickened area in the wall of the colon, about an inch and a half in diameter, was excised and the opening closed with three layers of sutures. The abdominal wall was then closed in layers, with drainage. The patient made an uneventful recovery from the operation, and left the hospital in four weeks, a small fecal fistula having remained opened for about two weeks.

The pathologist's report showed that the specimen removed consisted of the appendix and two sections of the wall of the cæcum, both of which were considerably thickened. In one of the sections there was a small saccule, 8 mm. in diameter, lined with mucous membrane, which appeared to have been pushed through the muscularis. A small perforation was found in the blind end of the saccule. Microscopically, the sections showed a small sac lined with normal intestinal mucosa which was thrown up into small folds. The wall of the sac was composed of fibrous tissue, densely infiltrated with polymorphonuclear leucocytes and lymphoid cells. No muscular coat remained in the wall. Its point of termination on either side of the sac was sharply defined. The terminal muscle fibres showed signs of atrophy, and were being replaced by fibrous tissue.

Diagnosis: Acute suppurative diverticulitis, with chronic appendicitis and typhlitis.

The case showed two points of special interest: first, the absence of the causes usually considered operative in diverticular development, advanced age, excessive fat or excessive emaciation; and second, the locations of the disease in cæcum or the ascending colon instead of the descending colon or sigmoid.

SIGNIFICANCE OF THYROIDISM.

DR. JOHN ROGERS read a paper on the above subject, for which see page 145.

In connection with his paper, Dr. Rogers showed a number

of patients which illustrated the various types of thyroid enlargement.

Dr. Rogers, in reply to a question, said that patients who were suffering from thyroidism usually took ether badly and were poor subjects for operation. When an operation on them was necessary, he thought it should be done under nitrous oxide anæsthesia.

In reply to Dr. Moschowitz as to how he explained the exophthalmus in these patients, Dr. Rogers said he could not explain it. He regarded that as the most obscure feature of the symptom-complex.

Dr. ELIOT said he recently saw in consultation a patient aged 40 years, with thyroid enlargement of six years' standing, who had been operated on for chronic appendicitis. Ether was used; the operation lasted less than an hour. At its completion the patient failed to regain consciousness and developed alternate delirium and stupor. The pulse ranged about 80 for six hours and then rose to 120 or 130. The delirium became more violent, requiring the use of morphine to control it. The temperature gradually rose, and the patient died fifty-six hours after operation, without having regained consciousness. He asked whether the symptoms in such a case could be ascribed to acute thyroidism? This patient had an exophthalmic goitre in a quiescent condition, a moderate acceleration of the pulse being the only symptom associated with a slight increase in the size of the gland, which was readily controlled by weekly applications of the Faradic current.

Dr. ROGERS replied that in the case mentioned by Dr. Eliot there was undoubtedly an acute toxæmia from the effect produced by the ether, probably on the liver. The speaker said he had heard of several similar cases. No remedy for the condition had been suggested.

TUBERCULOSIS OF THE KIDNEY.

Dr. ALEX. B. JOHNSON showed a tubercular kidney with numerous submaxillary tubercles in the cortex and a large superficial tubercular ulcer in the pelvis. Tubercle bacilli were found in the urine before the operation. The lesion was a very recent and acute one. He had never seen a specimen of a tuberculous kidney removed at so early a stage of the disease.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, November 1, 1909.

The President, DR. WILLIAM J. TAYLOR, in the Chair.

BULLET WOUNDS OF THE CHEST, INVOLVING THE LUNG.

DR. JAMES A. KELLY reported the histories of three cases of bullet wounds of the chest, involving the lung, which had recovered after thoracotomy.

CASE I.—*Bullet wound of lung: Hæmothorax resulting in empyæma: Thoracotomy with resection of eighth rib sixteen days after injury.*—A man, aged 21 years, was admitted to St. Mary's Hospital, September 6, 1907, with this history: While in the act of robbing a freight car he was detected, and while running away was shot in the back, about 12.30 A.M. by an officer. He was admitted to the hospital about one-half hour later. Patient stated that after being shot he was able to walk about one square when he became faint and fell to the ground.

When admitted he was in a state of marked collapse—pale, covered with a cold perspiration, extremities cold, voice weak, markedly dyspnoëic. Temperature 94, pulse 140, and respirations 36. When seen about one hour after admission patient was in a state of extreme shock, and symptoms presented were about the same as on admission. Examination of the chest showed an irregular punctured wound about $1\frac{1}{2}$ to 2 inches below the lower angle of the left scapula. Anteriorly, above and at the junction of the third rib and the costal cartilage there could be felt a small hard mass which was apparently the bullet. This could be felt just beneath the skin. Examination of the left lung showed the presence of moist râles at the apex, and an area of dullness extending upward to the sixth rib posteriorly. Marked cellular emphysema of anterior and lateral aspects of the left chest wall. On account of the patient's condition operative interference was

not considered. He was given morph. sulph. gr. $\frac{1}{4}$ hypodermatically and an ice bag was placed over the left chest. From this time the case was treated expectantly, as he had reacted considerably by 8 o'clock the morning of admission. The temperature was then $100\frac{4}{5}$ degrees, pulse 160, and respirations 46.

During the first week the temperature was elevated, ranging from $101\frac{2}{5}$ to $99\frac{1}{5}$, the average temperature being about 101 degrees; at the end of seven days it reached normal once and then varied between normal and 102 , until the end of the sixteenth day. The pulse varied between 160 and 104, averaging about 130. The respirations varied between 46 and 24, averaging about 36. The patient did well during the first week, but during the second week his general condition did not improve as well as was expected, so that on the fifteenth day an exploratory puncture was made and a syringeful of bloody purulent fluid was obtained. Physical examination of the left chest at this time showed dullness reaching posteriorly to the second rib, and extending into the axilla. Pulmonary resonance was absent over this area, and above there were diminished breath sounds, and coarse moist râles.

Operation.—Sixteenth day: Ether anæsthesia. Thoracotomy with resection of eighth rib in posterior axillary line. On opening the pleural cavity a large quantity of bloody purulent fluid escaped, a rough estimate being between a pint and a quart. Examination of the pleural cavity showed the lung to be almost collapsed excepting where it was connected to the parietal pleura by soft adhesions. These latter were separated as well as possible and a double rubber drainage-tube introduced. The bullet was then removed through an anterior incision made over its position of lodgement. The bullet was of .38 calibre. The patient reacted well from the operation and the temperature reached normal at the end of the ninth day. At the end of two weeks the patient was out of bed, and he was discharged from the hospital with the fistula completely closed January 28, 1908, four months and three weeks after the injury.

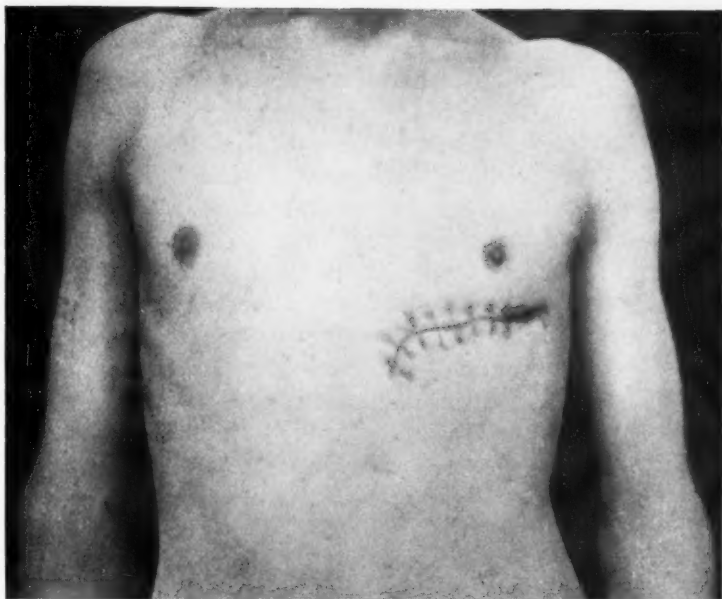
CASE II.—*Bullet wound of lung: Thoracotomy and resection of rib about four hours later: Artificial pneumothorax: Recovery.* A man, aged 23 years, was admitted to St. Mary's Hospital, September 11, 1909, soon after having shot himself with a revolver (.22 calibre). He was seen by the reporter about 3 to 4

hours after injury. He was then markedly collapsed, pale, skin covered with a cold, clammy perspiration, temperature $98\frac{3}{10}$, pulse 104, respiration 48. Examination of chest shows a small punctured wound, with blackened edges, over the sixth rib, about one inch outside the nipple line. No wound of exit seen, and location of bullet can not be determined. Percussion of left chest shows an area of dulness posteriorly from third rib downward extending into the axilla. Above this area of dulness there is normal resonance; breath sounds are normal excepting for some fine friction sounds. Patient has not coughed up any blood. On account of the patient's general condition and the apparent progressive nature of the symptoms it is decided to explore the pleural cavity and control the bleeding.

Operation: Chloroform anæsthesia. The track of the bullet was followed and it was found to have penetrated the sixth rib. The incision was then enlarged and the sixth rib resected from the costochondral junction posteriorly for a distance of about five to six inches. The pleural cavity was then opened, and was found to contain about one quart of blood and active bleeding from a punctured wound of the lung which was situated about two inches from the free margin and in the lower lobe. A wound of exit in the lung and also a wound of the posterior pleura corresponding to it was present. The blood in the pleural cavity was evacuated by means of dry gauze sponges and it was found by this time that the bleeding had ceased from the lung, which was collapsed. The pleural cavity was then closed with layer sutures except at a point posteriorly, where a double rubber tube was placed for drainage. The patient was returned to the ward in good condition.

Postoperative history: The postoperative temperature rose to 100 degrees, the pulse dropped to 30, and the respirations were 34. At 9 A.M. on the second day the temperature fell to 99 degrees, the respirations were 24, and the pulse 140. The temperature remained about 100 degrees, pulse 110, and respiration 28 on the third day. On the fourth day the temperature was $101\frac{4}{10}$ degrees, which fell on the fifth day to $99\frac{3}{10}$ degrees. For the remainder of the week the temperature varied between 99 and 101 degrees. During the second week the temperature fell to normal and the patient was allowed to sit up in a chair. During the third week the discharge, which had been serofibrinous,

FIG. 1.

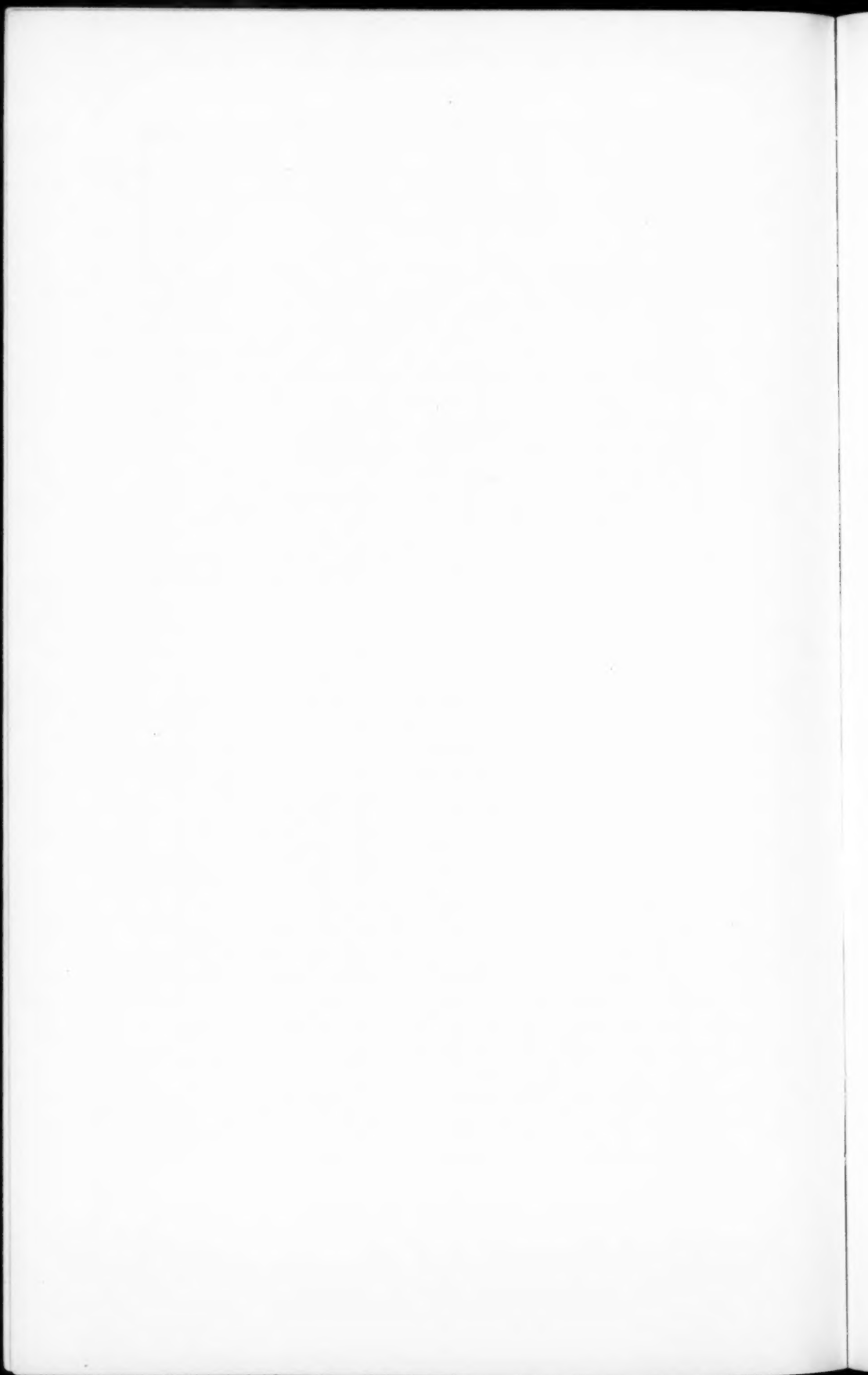


Case II.—Photograph taken on the forty-fifth day after injury, showing wound entirely healed excepting for drainage wound at its posterior end.

FIG. 2.



Case III.—Photograph taken on the thirty-eighth day after injury, showing wound entirely healed except at point of drainage at centre.



decreased in amount and the rubber drainage-tube was discontinued, but in a few days was reintroduced and a large collection of pus (about 14 oz.) was evacuated. Since then the patient has rapidly convalesced; the amount of discharge has rapidly decreased, the lung has expanded so that at present there is a small cavity which contains about 2 ounces of seropurulent fluid (Fig. 1).

CASE III.—*Bullet wound of lung: Thoracotomy with resection of sixth rib one hour later: Sutures of two wounds of lung: Recovery.*—A man, aged 38 years, was admitted to St. Mary's Hospital, September 22, 1909. While suffering from delusions and mental depression the patient had shot himself in the left side of the chest with a revolver of .38 calibre. He was admitted to the hospital about one-half hour after injury, at 5 P.M.

- On admission he was pale and anxious. There was marked respiratory difficulty, so that he could only breathe with difficulty when in the recumbent posture. Temperature on admission 99 degrees, pulse 164, respiration 36. Physical examination shows a bullet wound having a large ragged wound of entrance with blackened edges in the left nipple line and sixth interspace. With each inspiration and expiration there is a stream of blood ejected from the wound, which is large enough to admit the tip of the index finger. Examination of the left lung shows all the signs of collapse, with the presence of fluid at the base. As patient's condition was becoming progressively worse an exploratory thoracotomy was decided upon to control the hemorrhage.

Operation: Chloroform anæsthesia, one and a half hours after injury. Exploration of the wound with the finger showed it to be continuous with the pleural cavity. A transverse incision was then made from the costochondral junction over the sixth rib to anterior axillary line, and the sixth rib resected for a distance of about 5 to 6 inches, and the pleural cavity opened. Exploration of the pleural cavity showed the presence of a large amount of fluid blood, a collapsed lung, and two wounds of the latter—one of the lower lobe about one inch from the free border, and one of the lower and outer portion of the upper lobe near its lower edge. Wounds of exit were present in both lobes. The wounds were large, measuring about 3 cm. long and 1 cm. in width. Both wounds were bleeding very actively. The blood in the pleural cavity was removed with dry gauze sponges and then each lobe of the lung was seized with a flat wide-bladed

forceps, separately drawn into the wound and the bleeding controlled by means of interrupted No. 1 catgut sutures. The track of the bullet in the chest wall was excised, and the wound of the chest wall closed with layered sutures of catgut and silkworm gut, excepting at the posterior end where a double rubber-tube was placed for drainage. The patient was returned to the ward in a condition of shock, which lasted for several hours.

Postoperative history: At 12.30 A.M., about six hours after the operation, the temperature rose to $100\frac{2}{5}$ degrees, and at six o'clock the temperature was $99\frac{3}{5}$ degrees. The pulse rate fell from its maximum of 164 to 130 shortly after the operation; six hours after it was 120, and the next morning it was 100. The respirations fell to 24 after the operation, and were 36 next morning. During the first week the temperature varied from $99\frac{2}{5}$ to $102\frac{4}{5}$ degrees. The discharge from the wound was at first bloody, but at the end of the week it had become serofibrinous. During the second week the temperature varied from 99 to $101\frac{4}{5}$ degrees; the pulse rate varied from 102 to 90 in the evenings and from 94 to 78 in the mornings, and the respirations varied from 30 to 18. During the third week the patient sat up in a chair and the temperature reached normal. The discharge from the wound became purulent and rather profuse in amount. Since this time the patient has been progressing very favorably. The wound still discharges a small amount of purulent fluid and there is a small cavity containing about 2 ounces of pus. The lung has expanded well and the patient is gradually becoming much stronger (Fig. 2).

Dr. Kelly remarked that bullet wounds of the chest wall involving the lung may be divided into two classes: (1) those in which there is evidence of a hæmothorax or a pneumothorax, but the symptoms of shock and hemorrhage are not severe or progressive in character, and (2) those in which the symptoms of shock and hemorrhage, and especially the latter, are progressive in character. In the first class immediate operative interference is not indicated, but one should delay, and future operative interference should not be considered unless there is evidence of non-absorption of the blood in the pleural cavity, or the hæmothorax has become an empyema. An operation to recover the bullet is not considered advisable unless it is superficial in position, and then only after the signs of shock have entirely disappeared. In

the second class of cases immediate operative interference is considered advisable (1) when the symptoms of shock and hemorrhage are progressive in character, (2) when there is evidence of active hemorrhage combined with a pneumothorax (the presence of active bleeding from a bullet wound combined with a pneumothorax shows that the collapse of the lung has not controlled the bleeding), (3) when there is evidence of increased bleeding operative interference may control it by the production of a pneumothorax, and if the bleeding is not controlled in this manner, direct suture of the lung tissue may readily be performed.

While the opening of the thoracic cavity under positive or negative pressure would facilitate the localizing of the seat of the hemorrhage and lessen the amount of operative shock, yet at the same time it would in all probability have increased the hemorrhage.

While the last two cases were drained the reporter would be inclined to close up the wound in the chest wall without drainage, provided the wound of entrance could be thoroughly excised and the bullet removed.

DR. JOHN H. JOPSON said that very few cases of control of pulmonary hemorrhage by suture are on record. In 1908 Kuttner was able to collect but 6 cases of suture of the lung for gunshot wounds and nine cases of the lung for stab wound, with 6 recoveries. These cases were all reported from the foreign literature. Several years ago Dr. Jopson reported one case of suture of the lung before the Academy for stab wound, which terminated in recovery. It is undoubtedly true that in a number of cases simply opening the chest and establishing a pneumothorax seems to control hemorrhage, but this does not always suffice. In one case of gunshot wound of the lung on which he operated the exploration was undertaken with the idea that the heart had been wounded; the bullet had entered in the third interspace an inch and a half to the left of the sternum, and the symptoms were those of pericardial distention and interference with the heart action. In that case he turned in a quadrilateral flap and had the same experience as had Dr. Kelly in one of his cases, the production of a pneumothorax sufficient to result in the control of the hemorrhage. A laparotomy pad was inserted into the pleural cavity to control active hemorrhage during the stage when the patient's condition was most alarming, and the

withdrawal of the pad was followed by arrest of hemorrhage, and he closed the wound immediately. The patient died of delirium tremens on the fourth day without any return of the hemorrhage. In the case of suture of the lung referred to, the hemorrhage was not entirely controlled by primary exploration and pneumothorax, and a running stitch of catgut to the wound on the edge of the large lobe of the lung was necessary for its complete control. In every case where drainage has been instituted it has been his experience that there has been some infection of the pleura, and this experience has been borne out by the experimental studies of Nötzl, showing the great susceptibility of the pleura to infection where pneumothorax is present. This is not a contra-indication to drainage, because where good drainage is instituted the infection is usually rapidly thrown off. In cases of doubt drainage should be instituted.

DR. JOHN H. GIBBON said that one of the difficult questions in the treatment of gunshot wounds of the chest is to decide which case should be operated upon and which should be left alone. In most of the gunshot wounds of the lung from small calibre bullets, although the condition may be alarming at first, the hemorrhage usually ceases and the patient recovers. That is one reason surgeons should be careful in the selection of cases. Another is the point that after an operation drainage is necessary, and that whenever drainage is instituted practically always there is infection. These cases reported by Dr. Kelly are rather good illustrations of those in which operation should be undertaken. He thought, however, that a mistake has been made much more often in operating upon cases of gunshot wound of the lung than in not operating. A great many of these cases which look hopeless for a while get well; some develop an empyema later and have to be operated upon, but his own idea is not to operate unless they show such symptoms as those displayed by Dr. Kelly's second case. Stab wounds are more apt to require operative interference than gunshot wounds with small calibre bullets. Gunshot wounds received on the battlefield do not require operation so frequently as do those in civil life.

DR. ROBERT G. LE CONTE said that the question of drainage in these cases is not always an easy one to decide. He agreed with Dr. Jopson that drainage is apt to be followed by some infection, but whether the infection is due to the drainage *per se*,

or to material which has already been carried into the pleura by the primary injury, is a question. When the wound is clean, as it frequently is in a knife-cut, he would have no more fear of draining the pleura than of draining the peritoneum. It is to be remembered that there are two sources from which infection can take place besides the drainage track: externally from material carried in at the time of the injury, and internally, by the opening of a bronchus. Should infection take place from either of these sources, drainage of the pleural cavity will certainly limit the extent of the pyothorax. When the pleural cavity is clean at the time of operation, there is small chance of infection taking place through the drainage track when properly safeguarded. In the majority of cases the bleeding from the lung will be controlled by the admission of air to the pleural cavity and collapse of the lung, in both gunshot and stab wounds. In his limited experience he had not yet had to suture the lung to control bleeding.

DR. FRANCIS T. STEWART said that his own rule in these cases is somewhat as follows: If he feels sure that the lung alone has been injured, either by gunshot or stab wound, he does not operate unless the wound is near the root of the lung. Hemorrhage from the lung itself almost invariably controls itself, particularly if some air is allowed to get into the thoracic cavity. He had seen a good many cases in which he had not operated and which had done well. He had explored a number of cases, however, because he thought the heart was injured or that the diaphragm was penetrated. If there is any question of a wound of the heart or penetration of the diaphragm, or injury of the large vessels, exploration should be carried out and hemorrhage controlled. If the parenchymatous tissue of the lung alone is wounded the bleeding usually ceases of its own accord or as the result of collapse of the lung and pneumothorax. There may be cases of large wounds of the lung which will die from hemorrhage alone, and perhaps in some of these cases suture or packing would be indicated.

DR. JOHN B. ROBERTS said that one of the interesting features of these cases was the greater rapidity in the cure of the operative cases than in the cases which were allowed to go on until an empyema occurred. He agreed with several of those who had spoken, that gunshot wounds of the lung are frequently cured without operation,—yet he felt that the cases just reported seem

to have recovered more quickly than if they had not been promptly opened. He had found in some of these cases which do badly from acute traumatic pneumonia that a prompt phlebotomy has been of service.

DR. J. E. SWEET said that certain experimental observations had suggested to him a possible mode of infection after wounds of the chest, which might have some decisive bearing upon the question of drainage. The phagocytes can take up bacteria from the alveoli and possibly the bronchioles of the lung; such phagocytosed organisms are not immediately killed in the body of the leucocyte. These phagocytes normally wander to the spleen or bone marrow, perhaps; but an irritation of the pleura might attract them to the wound and the organisms becoming free, an infection could result.

ARTERIOVENOUS ANASTOMOSIS FOR GANGRENE OF FOOT.

DR. GEORGE P. MÜLLER read a paper with the above title, for which see page 246.

DR. J. E. SWEET said the fact of the previous operation in Dr. Müller's first case leaves little opportunity for discussion; the operation chosen was the only surgical possibility. Had it not been for the first operation, the use of formalinized arteries would have come into the discussion. They had been surprised in the laboratory to note the slight reaction caused in the substance of the brain by an artery hardened in formalin. The suggestion to use such material in aneurysms seems practical, but he did not know of its having been tried.

It sometimes seems as if the workers with human material were somewhat slow to adopt the suggestions of the laboratory. Possibly Dr. Müller's second case is an example of the reason why the laboratory suggestions are not more readily adopted, they are not always practical, as in the suggestion of the transposition of the circulation for gangrene which is hardly practicable. If the course of an artery to its capillaries is followed it will be found that the blood gradually becomes venous from the processes of anabolism and katabolism; in other words, the capillaries, upon which the life of the tissue depends, are half venous, half arterial. If the blood will not pass through the arterial half of the capillary, when pursuing its normal course, one fails to see how it can if led to the capillary from the venous side.

DR. GEORGE P. MÜLLER added that it does not seem feasible, physiologically, to effect reversal of the circulation, but Carrell reports having done so in dogs. Of course if the artery is thrombosed it is impossible to effect the reversal, as the blood must leak through the large veins which unite the deep and superficial venous vessels, and therefore fail to reach the foot. It is impossible, if gangrene is once established, to send sufficient blood to the foot to prevent gangrene from spreading beyond the toes, but he believed it to be possible almost always to obtain sufficient circulation to enable the amputation to be done in the leg.

MALIGNANT DEGENERATION OF BENIGN DISEASE OF
THE BREAST.

DR. JOHN SPEESE read a paper with the above title for which see page 212.

DR. WILLIAM L. RODMAN said that it is beginning to be appreciated that all benign tumors in every part of the body are liable to malignant degeneration, and that this is more likely to occur in the breast than elsewhere, on account of the fact that the soil of the mammary gland is fertile to cancer. He did not, however, think it to be appreciated as sufficiently as it ought to be that the danger of any benign tumor undergoing malignant change sooner or later, is as great as it is; as Dr. Speese had said. there are certain varieties of neoplasms more prone to undergo carcinomatous change than others. The papillary cyst adenoma he should consider the most likely to undergo malignant change. In the first place it is with difficulty differentiated from malignant disease; so is involution mastitis. Papillary cyst adenoma is, however, more likely to involve the central part of the gland and to be just behind the areola; whereas involution mastitis particularly is more likely to involve the periphery of the gland. There would be more difficulty in differentiating between papillary cyst adenoma and involution mastitis than between papillary cyst adenoma and carcinoma. The age of the patient is also a help. Papillary cyst adenoma is usually more apt to occur about 50, and there is very little pain, whereas there is much pain in involution mastitis. There is, however, such a similarity regarding age in these various conditions, that the only safe way of making a diagnosis is by an exploratory incision, which should only be done after the consent of the patient has been obtained for a complete

operation should one be deemed necessary. He had always believed a great deal in the value of macroscopic appearances, still he would take issue with Dr. Speese, in that he did not think the macroscopic appearance can possibly be of as great value as the frozen section. He would not depend entirely upon a frozen section, but he did think them practically safe and reliable and never operates a suspicious case without the presence of a competent pathologist and his freezing microtome. This plan he had followed for 17 years and had known but two mistakes made in diagnosis by depending upon frozen sections. Very recently some of the most prominent members of the Philadelphia Pathological Society materially differed concerning the nature of a breast he removed at the Presbyterian Hospital. Some thought it sarcoma, others carcinoma, and others still that parts were carcinomatous and parts sarcomatous. These examinations were not made quickly and after frozen sections but weeks and months after the breast was removed. It was referred to a committee for final report. If such differences occur after the better and more accurate way of interpreting the microscope, of course it can, and will occasionally occur when frozen sections are relied upon.

DR. GEORGE G. ROSS said that he would not belittle frozen sections, but they are usually made with great haste, the selection of the portion is not always a careful one, and there is great possibility for error. If a portion of the most suspicious part of the tumor were always selected, and if the section were always well stained, these reports would be of much greater value. He believed, however, that the macroscopic appearance, particularly to a man who has had experience, is a better guide in deciding at the operating table. The ideal time for operating on carcinoma is before it really exists.

DR. GEORGE P. MÜLLER said that he did not believe malignancy as a rule occurs in fibroma; in those cases where it does develop he believed it to be accidental or else to be one of the fibrous forms of cystic adenoma, because the tissues are so compressed that the epithelium is practically atrophic and incapable of malignant reversion. With regard to enlargement of breast tumors in pregnancy one should be careful not to attach too much importance to rapid growth during this period. As to the age of the patient, he would take exception to the common statement that

45 is the age at which cancer appears, or that 40 is the age at which the diffused cystic hyperplasia is most apt to be seen. Every one has seen cases of cancer under thirty, and age should have nothing to do with the diagnosis in the individual case. As to the use of the frozen section he agreed with Dr. Speese; he had used it for many years and had come to distrust his own judgment in the matter. He believed with Speese and Bloodgood that the frozen section had not the value that many surgeons attach to it and that more attention should be paid to the naked eye appearance of the growth.

The plastic operation of Warren should be adopted with great caution, and only used in cases of abnormal involution of the cystic type.

LEUKÆMIA RESEMBLING PYONEPHROSIS.

DR. FRANCIS T. STEWART reported the case of a man aged 47 years, who was admitted to the Jefferson Hospital July 23, 1909, for pyonephrosis which had ruptured into the bowel.

The trouble began 16 years ago after an attack of typhoid fever, when he began to complain of dull pain in the left loin. The pain was associated with a swelling in this region which disappeared with the cessation of the pain. The pain and tumor have come and gone a number of times, sometimes suddenly but more often gradually. They have occurred as often as once a month and have sometimes remained absent for as long as four months. The pain is usually dull and aching in character but occasionally severe and lancinating and sometimes referred to the left testicle. The last severe attack occurred in May, 1909. There was intense and agonizing pain, with fever, sweating, vomiting, and headache. The urinary output was lessened during the attack but towards its end became whitish, profuse, and finally red and fetid. About four days after the onset of this paroxysm he was suddenly relieved of his pain and shortly afterwards passed a large quantity of sanguineous pus by the bowel. Since this time the bowel movements have always contained some pus and blood.

The patient is tall and thin and has lost much weight. The skin is pale and dry and the mucous membrane anæmic. There are many enlarged lymphatic glands in the posterior cervical triangles, both axillæ, and both groins, the largest measuring about 2.5 cm. in diameter. They are painless and freely movable. The thoracic organs are normal.

The abdomen is symmetrical in contour, soft, and not painful. There is an indefinite resistance in the left flank but no rigidity or demonstrable mass. The liver and spleen are apparently normal.

Blood examination: Hæmoglobin 80 per cent., red cells 6,000,000, color index .6, leucocytes 9200. The feces showed blood and pus but no free fat. Rosenberger's test for tubercle bacilli negative. On cystoscopic examination the bladder and ureteral orifices showed no pathological change. A catheter was passed up each ureter to the kidney without meeting with any obstructions. The left kidney secreted 8 c.c. while the right secreted 75 c.c. of urine. The urine from each side was practically identical and showed no abnormality except a few red blood cells; no tubercle bacilli could be found. Methylene blue appeared in the urine from the right kidney in one hour and in the left in one hour and fifteen minutes after being swallowed. No methylene blue appeared in the stools although some of the drug was injected directly into the pelvis of the left kidney. An X-ray examination of both kidneys and ureters showed no stone.

Having improved somewhat while in the hospital the patient decided to leave and to return if the improvement did not continue. In September he was readmitted to the hospital; he had lost more weight and the pain had returned. Upon reinvestigation the spleen could be palpated, and extended from the seventh rib to within two fingerbreadths of the iliac crest. The urine was normal except for a slight trace of albumin. The blood showed: hæmoglobin 65 per cent., red cells 4,300,000, white cells 56,000, color index .7. A differential count of the leucocytes showed polymorphonuclears 6 per cent., lymphocytes 81 per cent., hyaline 7 per cent., degenerated 6 per cent. Later the lymphocytes ascended to 89 per cent. Proctoscopic examination revealed a few small ulcers and numerous polypi, the largest of which was one and a quarter inches in diameter; they were pale, firm and slightly tender. On the 28th of September the temperature rose to 101 and the pain in the loin was severe; during the night the temperature fell to normal, the pain almost wholly subsided, and there was a profuse discharge of pus and blood from the bowel. The following day the spleen could not be palpated.

In this case, in the opinion of Dr. Stewart, the pain and swelling in the left loin are due to engorgement of the spleen, which

shrinks as the result of a free hemorrhage into the bowel, a not uncommon complication in leukæmia. The pus in the feces comes from the ulcers and polyps in the rectum and colon; perhaps the latter are leukæmic tumors.

SARCOMA OF THE PSOAS MUSCLE TREATED BY EXCISION,
X-RAY AND COLEY'S FLUID.

DR. STEWART also reported the history of a man, R. G., 27 years of age, who was admitted to the Jefferson Hospital September 12, 1908. In December, 1907, while lifting a heavy stone he felt a sharp pain in the right iliac region, but this subsided after a time and left a dull ache. About four months later he noticed a swelling in the lower right abdomen; this increased in size and finally filled the iliac fossa, almost reaching the median line. It was very firm on palpation but could not be demonstrated with X-ray. It was smooth, and moderately tender, and was intimately attached to the iliac bone. When the thigh was extended there was an audible click in the hip-joint. On September 15, 1908, an incision was made along the iliac crest and Poupart's ligament, severing the muscles of the abdominal wall. The peritoneum was then displaced inwards, the iliac vessels, which skirted the inner side of the growth, retracted towards the median line, and the tumor, together with the iliopsoas muscle, from which it sprang, excised. It was necessary to sever Poupart's ligament in order to cut the muscle close to the femur. The growth had infiltrated the inner table of the ilium over an area about 3 inches in diameter. The bone in this region was removed with a curette and the bleeding checked with Horsley's wax. The wound was sutured except at its upper end, which was left open for the exit of a gauze drain. On microscopic examination the tumor proved to be a round-celled sarcoma. About a month after operation a diffuse swelling could be felt beneath the scar and this was thought to be a recurrence. A sinus still existed at the point where the drain had been placed but there were no evidences of retention of pus or of inflammation. The patient was given X-ray treatment every second day. Two months after operation the skin in the region of the wound became red and tender and the patient was forced to his bed because of fever and weakness. This area of inflammation, probably erysipelas, extended down over the gluteal region and upper third of the thigh. The sinus

was still open. The fever lasted about 10 days and disappeared with the subsidence of the inflammation. The swelling in the right abdomen slowly increased in size until the advent of the erysipelatous inflammation, after which it seemed to remain stationary. On February 25, 1909, the subcutaneous administration of Coley's fluid was begun, but no reaction could be obtained, although the dose was run up to 7 drops. On March 3 a new fluid was obtained, 3 drops of which gave a decided reaction. These injections were continued up until March 25, the maximum dose being 8 drops. A second febrile reaction was not obtained. During the administration of Coley's fluid the growth began to shrink, finally disappearing sometime in May, 1909. The X-ray treatment was continued throughout the treatment, and is still given at intervals to guard against recurrence. The patient has gained 40 pounds in weight.

DR. GEORGE P. MÜLLER said with regard to the first case, that he saw one of a similar nature some 8 or 9 years ago when a resident in the German Hospital. A woman of about 35 was admitted to Dr. Deaver's service with a history of having been delivered of a child; six weeks previously she had fever and chills and was thought to have an infected uterus. A blood count made as a matter of routine showed 100,000 leucocytes, and a diagnosis of acute lymphatic leukæmia was easily made.

With regard to Dr. Stewart's second case, he recalled a patient, 28 years old, admitted to Dr. Frazier's wards in the University Hospital, upon whom he operated for a large lymphosarcoma of the neck; this was dissected out and in a month there was a recurrence along the trapezius which was also removed. The patient was then treated with Coley's toxin and is well at the present time and free from recurrence, one year after operation. He had had other cases treated with Coley's toxin with entire failure.

DR. JOHN H. GIBBON said that he saw both the cases reported by Dr. Stewart. In the first without the blood count one might easily have made the mistake of operating.

The second case reported is the second case he had seen with an apparent cure after the use of Coley's toxin. He had used Coley's toxins religiously in inoperable sarcoma, and even in cases where he thought he had removed the growth. The other case is that of a young girl 16 or 17 years of age upon whom he operated at the Jefferson Hospital in February, 1908, removing an

osteosarcoma of the humerus. He wanted to do a shoulder-joint amputation, and explained the situation to the family, but they would not consent, although the girl herself was anxious to have it done. He then started her out on Coley's toxins and also gave her X-ray treatment which Dr. Manges carried out persistently. He did not remember just how long it has been since the operation, but about 18 months, and she is now apparently perfectly well. These are the only two cases in which the combination of the X-rays and Coley's toxins have in his experience worked an apparent cure, although he had combined this treatment in practically all of his cases. This case reported by Dr. Stewart was 27 years of age, Dr. Müller's patient 28, and his own case under twenty, so there are three cases under thirty, and he thought we should therefore continue to use these two remedies in even what appear to be hopeless cases.

DR. JOHN B. SHOBER added one case of sarcoma occurring in a young married woman, cured by means of operation and treatment by the X-ray without Coley's toxin. The patient was 27 years of age. Upon operation upon a growth in the forearm he found a cystic spindle-celled sarcoma developing from the interosseous tissue. By an extensive operation he thought he had removed the entire growth, including the cyst wall, but after a few months there was recurrence of the tumor. He then urged operation which she declined. She subsequently fell into the hands of Dr. Pfahler, who treated her with the X-rays and he sent her to see him some years later entirely cured.

His limited experience with Coley's serum in these cases has been disappointing. He would prefer in the future to rely upon first operation and then the use of strong radium bromide, the X-rays, or both.

DR. WILLIAM L. RODMAN said there is one point in connection with this case, and that is if it does prove to be a radical cure it will be most interesting, insomuch as it was a round-celled sarcoma, which is the least favorable variety for the toxin, as pointed out by Coley himself. Personally he had been using Coley's toxin since 1894 and had seen a decided improvement in many cases but was sorry to say he had not seen a cure in any cases. He had seen several cases cured by the X-rays alone. He had no faith in the treatment of carcinoma by the X-rays as he thought, on the whole, more harm than good had resulted from such treat-

ment. Only superficial epitheliomata are cured by X-ray treatment. It is very different with sarcoma. In all inoperable sarcomata Coley's toxins and the X-rays should be used conjointly as both are often helpful and sometimes curative. He had seen several of Coley's cured cases and a colleague in Louisville, Dr. M. F. Corrum, at his suggestion, used the toxins successfully 13 years ago in a very advanced sarcoma of the throat.

DR. FRANCIS T. STEWART (in closing) said he had used Coley's toxin in all inoperable cases of sarcoma and in most, if not all, cases of sarcoma after operation, but this was the first time he had had any encouragement. Whether this improvement is due to the Coley's toxin, the X-ray, or the erysipelatos infection, or whether it is due to some other condition of an obscure nature, he did not know.

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